ARMED FORCES CHEMICAL JOURNAL

IN THIS ISSUE—

"EFFECTIVE DISASTER CONTROL"—by Col. Appel; "INDUSTRY'S NEW 'GENII'—THE RADIOISOTOPES" — by Jack Townsend, and other matter of current interest on atomic energy.

—U. S. Army Photo

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COVER PHOTO

A radiological survey team at the Chemical Corps School, Fort McClellan, Alabama, demonstrates uses of radiation detection instruments, recording and plotting of hazard data and telephonic reporting procedures. Each team member in picture shown is equipped with a lightweight dust respirator.

Article, "Effective Disaster Control," in this issue emphasizes need for speedy rescue work in atomic disasters and proposes techniques designed to obviate dependence on time-consuming pre-rescue surveys.

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ARMED FORCES CHEMICAL ASSOCIATION

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WENDELL F. JACKSON MADE MEETINGS VICE PRESIDENT

Colonel John M. MacGregor, New York attorney, who was recently elected Vice President of the Association and Chairman of the Meetings Committee, tendered his resignation in a letter to President Glenn Hutt, which was read at the meeting of the Executive Committee in Washington, D. C., on October 14. Colonel MacGregor wrote that he has recently been ill and that his doctor has directed substantial curtailment of activities until he fully regains his health. The resignation was accepted with regret.

The Committee by unanimous vote elected Dr. Wendell F. Jackson, of E.I. du Pont de Nemours and Co., Inc., a member of the Wilmington Chapter, to fill the unexpired term of Colonel MacGregor. The members expressed opinion that the Association is most fortunate in this appointment and noted also that it will facilitate arrangements for the next annual meeting to be held in Atlantic City, since both Wilmington and New York Chapters are to cooperate in developing the program.

WILMINGTON RECEIVES NOMINATIONS FOR 1958

The Wilmington, Del., Chapter, at a dinner meeting on September 17, received the following nominations for the election of officers for 1958 to be held at the final meeting this year.

For president, Mr. Henry T. Clark, Atlas Powder Co.; first vice president, Dr. William G. Kinsinger, Hercules Powder Co.; second vice president, Dr. William W. Hess, E. I. du Pont de Nemours & Co., Inc.; and secretary-treasurer, Mr. William J. Taylor, Jr., Atlas Powder Co. Mr. Ford McBerty, Chapter president, stated that the nominations were presented at this earlier meeting in order to give opportunity for any further nominations to be received before the elections. The list was announnced by Mr. A. L. Churchill, chairman of the Nominating Committee.

The Chapter was addressed by Colonel J. E. Golden on the subject of the phase-out work of the Delaware District of the Second Army and its replacement by the XXI Corps.

The Chapter decided to appropriate $100 as a Science Teacher Award.

A.F.C.A. EMPLOYMENT AID

The Armed Forces Chemical Association will attempt to assist certain Chemical Corps personnel to find employment in industry when and if they are separated from the Chemical Corps.

Such action will involve only personnel separated without discredit, who are members of this Association, have scientific or technical training and who request such assistance and present their qualifications in an acceptable manner.

All applications for assistance should be filed with the Association Headquarters, Suite 408, Park Lane Building, 2025 Eye Street, NW., Washington 6, D.C.

Each application for assistance should be accompanied by six fully legible copies of an outline of experience presented in general conformity with Civil Service form No. 57.

The Association will seek to gain from among its corporate members consideration by one or more companies of applicant's qualifications for employment, and, as may be indicated, to arrange for an interview of the applicant by a company representative.

The Association will handle all cases in the order in which they are received and without distinction as to whether the applicant was in the military service or was a civilian employee of the Corps.

RESOLUTION HONORING THE MEMORY OF THE LATE FRED M. JACOBS, FORMER A. F. C. A. SECRETARY

The Executive Committee of A.F.C.A. at its meeting in Washington, D.C., August 19, unanimously adopted a resolution in honor of the memory of the late Mr. Fred M. Jacobs, former Secretary-Treasurer of the Association. The resolution reads as follows:

RESOLVED, That it is the sense of the Executive Committee of the Armed Forces Chemical Association that the entire Association, the Board of Directors, the Executive Committee, and the rank and file have suffered a most grievous loss through the death of Mr. Fred M. Jacobs, past Secretary-Treasurer of our Association. Mr. Jacobs gave generously and wholeheartedly of his most splendid best to the A.F.C.A. Through his efforts, this organization lived and grew more through his devotion than through all other causes. We honor the man whom we respected as our Association's saviour and loved as a man. We pray that God will grant him everlasting peace.

Mr. Jacobs, who served as Secretary-Treasurer from January 1948 to January 1954, died at his home in Washington, D.C., on June 26.

Mr. Jacobs was born in St. Louis, Missouri, in 1878. He attended Washington University there, and engaged initially in business in that area; subsequently became a business executive and organizer in Chicago and New York. In 1942 he joined the staff of the New York Chemical Warfare Procurement District and later transferred to the office of the Chief of Chemical Warfare Service in Washington, D.C., where he became Executive of the Control Division. He remained in the Chemical Corps until his retirement from the government service. Mr. Jacobs had a wide acquaintance, particularly among the members of the Association.

THOMAS S. WALSH, CAPT., USAR

Mr. Thomas S. Walsh, an attorney and member of The Washington, D.C. chapter of A.F.C.A. died on August 31, 1957 as a result of an automobile accident. Mr. Walsh enlisted in the ERC at Williams College in 1943 and served in the Chemical Corps until August 1946. He was educated at Cherry Valley School, Garden City, N. Y., Williams College and the University of Michigan Law School, and was a member of Beta Theta Pi, Delta Sigma Rho and Delta Theta Phi fraternities.

He was engaged in the practice of law in Washington, D.C., and was a member of the Court House Country Club, the Counsellors Club of Washington, and the District of Columbia, Michigan and American Bar Associations.

He is survived by his parents, Mr. and Mrs. Leo F. Walsh, of Washington, D.C.

SAN FRANCISCO CHAPTER HEARS TALK ON FUELS

"High Energy Fuels" was the topic for discussion when the members of the San Francisco Chapter and guests from the Rocket Society assembled for the Chapter's fall meeting at the Presidio of San Francisco on September 26, 1957. Mr. Patrick Moran, Chapter President, opened the meeting by introducing and welcoming to the Bay Area three Chemical Corps officers recently assigned to the Sixth Army Area, Colonel LaPiana, Lt. Colonel Milburn, and Lt. Colonel Kosebutski.

Dr. Earl W. Weilmuenster, Director of High Energy Fuels Chemical Research for Olin-Mathieson Chemical Corporation, and leading authority in the field, was guest speaker. Dr. Weilmuenster presented an entertaining and stimulating discussion which gave his audience a comprehensive look at the development, production and utilization of these new fuels.

The meeting concluded with a tribute to Matthew J. Scott, a dean of the chemical industry in Northern California and a charter member of the group soon to retire.

Chapter officers elected for the coming year: President, Christian J. Matthews, Arthur D. Little, Inc.; vice president, Robert H. Kuhn, Rees Blowpipe Company; vice president, William Kay, Bechtel Corporation; Secretary-Treasurer, John Nimz, Union Carbide Chemicals Company.

GENERAL CREASY SPEAKER AT NEW YORK MEETING

Maj. General William M. Creasy, Chief Chemical Officer, Department of the Army, was announced as the speaker for the annual dinner meeting of the New York Chapter of the Association, at Hotel Delmonico, New York City, on November 7, in an advance notice from Mr. W. Ward Jackson, President of the Chapter.

In addition to members of the Association, invitation to attend was extended to active and reserve officers of the Chemical Corps and interested chemical industry representatives.

A.C.C. CHAPTER CHARTER PASSED TO NEW PRESIDENT

Lt. Colonel Allan C. Hamilton, (left) outgoing president of the Army Chemical Center Chapter, Armed Forces Chemical Association, presents the charter of the organization to the newly elected president, Colonel William J. Allen, Jr. Colonel Allen is the Commanding Officer of the Chemical Corps Engineering Command.

GENERAL McAULIFFE NOW A CYANAMID VICE PRESIDENT

General Anthony C. McAuliffe has been named vice president of American Cyanamid Company. He joined the company in May, 1956, upon his retirement as commander-in-chief of United States Army, Europe. During World War II, he served as deputy commander of the 101st Airborne Division. In that capacity, he parachuted into France in 1944 and commanded the glider echelon of the 101st in the airborne invasion of Holland. During the Battle of the Bulge, in the absence of the division commander, he commanded that Division in the defense of Bastogne.

General McAuliffe served as chief of the Army Chemical Corps from 1949 to 1951 and is an honorary life member of A.F.C.A.

NEW HISTORICAL SERIES IN CHEMICAL WARFARE

With this issue, the JOURNAL commences publication of a series of short historical articles bearing upon the origin or development of chemical warfare.

We are indebted for this series to Dr. Wyndham D. Miles, of the Historical Office of the Chemical Corps. Various members of that office have from time to time contributed to the JOURNAL. Among the current historical staff who have written for us are Dr. Leo P. Brophy, chief of the Historical Office; Mr. H. Gilman Wing; Dr. Brooks E. Kleber, a frequent contributor with his column, "The Historical Corner;" and also Dr. Miles.

The first two presentations of this new series by Dr. Miles, under the title—"Chapters in Chemical Warfare," deals with the proposals put forward to the British Government for use of toxic chemicals against Napoleon and against Russia in the Crimean War.

EFFECTIVE DISASTER CONTROL

—U.S. Army Photo

By **Lt. Col. John G. Appel, CMLC**

Realistic Exercises and Studies Conducted in the Canal Zone Are Cited by Colonel Appel as Showing Need for Faster Rescue Procedures in Atomic Disaster Situations; Proposed New Techniques for Coping with Radiation Hazards are Described; Important Role of Service Women in Zone Plans Is Noted.

Regardless of the size of any disaster, effective action by survivors can save human lives and property. The need for effective disaster control in all communities, particularly in this day of atomic and thermo-nuclear weapons, is greater than ever before. The extent to which positive action is taken to organize, train and test disaster control organizations and techniques of operations varies widely. In many instances it is really given little more than lip service. Effective disaster control means simple, realistic, practical efforts which will result in saving lives. An effective program should do much to attain and maintain a live disaster control organization.

Within the Panama Canal Zone an effective disaster control organization has been established. Detailed documents pertaining to organization, manning, functions and operations of disaster control forces are available. A live, effective training program is conducted. New personnel arriving in the Zone are immediately included in the organization and given appropriate training courses in first aid, communications and other subjects. Within all zones, the wives, or distaff element, are completely integrated in the plan of operations. In addition, disaster control zones at the various military and civil communities frequently conduct training exercises. Finally, on a Zone-wide basis, annual disaster control exercises are held. These are referred to as JACKPOT Exercises. These exercises are of considerable magnitude and much time and effort is given to creating the disaster scene and then in employing many disaster control forces to reduce the disaster. Each of these annual exercises involves several thousand individuals, both civilian and military. In short, disaster control in the Panama Canal Zone is a very real thing. The realism, spirit and enthusiasm with which personnel in the Zone support all phases of disaster control operations is outstanding. The results of the efforts of personnel within the Zone are certain to do much to minimize the damage from a disaster should it occur. Perhaps even more important is the fact that this large, active organization serves as an excellent vehicle to study disaster control organization, training and operational techniques. From such study, ways and means of increasing the efficiency and effectiveness of disaster control forces throughout the world can be obtained. Until recently, the disaster control exercises (JACKPOT series) in the Canal Zone followed the principles of disaster control as set forth in various Civil Defense publications. They proved to be time-consuming and complex and therefore, not sufficiently effective. The purpose of this article is to present some of the ideas learned which have now been incorporated in the Canal Zone organization with the hope that they will prove valuable to others.

In those instances where the disaster is caused by atomic or thermo-nuclear weapons and further, where a radiological hazard exists following the detonation of the weapon, disaster control operations need not be more complicated but they must be expeditiously carried out if the personnel casualties *that have a chance to be saved are saved.* With this thought in mind, primary consideration in making an analysis of disaster control operations must be to find ways and means through organization, training and operational techniques of speeding up disaster control operations and, at the same time, to recognize and control the hazard both to the victims of the attack and the disaster control personnel.

The usual procedure has been to employ various types of disaster control teams in a disaster area and control their time of stay based on information provided by radiological survey teams. This technique involves employing disaster forces in series, i.e., first, survey teams and second, firefighting, rescue, first aid and other teams. Control, once a team is committed, is extremely difficult due to limitations on vehicles and communications equipment. Experience has clearly shown that re-

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Lt. Colonel John G. Appel, author of the accompanying article, recently assigned as Commanding Officer of the U. S. Army Chemical Corps' New York Procurement District, was previously Chemical Officer, United States Army, Caribbean. A graduate chemical engineer from Rose Polytechnic Institute in Indiana, he received his commission in the Chemical Corps in 1941. During World War II he served at Edgewood Arsenal, Maryland, Camp Sibert, Alabama, and with a Chemical Base Depot in the European Theatre of Operations. Colonel Appel has attended the Command and General Staff School, the Chemical Corps Officer Advanced Course, and the Air Command and Staff School. He has served on the faculty of the Chemical Corps School and as Plans and Policies Officer, and later Deputy Chief for the Research and Engineering Division in the Office of the Chief Chemical Officer, Department of the Army.

liance cannot be placed on team personnel to understand radiation and to evacuate at the proper time based on "times of stay." Finally, the present techniques give primary consideration to "when disaster control forces can enter a contaminated area and how long they can safely remain in the area." In other words, this technique gives emphasis to radiological safety for the disaster control workers. It is necessary to give equal emphasis to the radiological safety for the victim. Figure 1 compares the time factors of the present or usual technique of operations with the time factors of a proposed technique together with the respective costs in personnel for personnel actually saved. The assumptions made are necessarily general, are applicable to various situations and represent average conditions. The experience gained from past JACKPOT exercises reveals that the average victim remained in a highly contaminated area two (2) hours and that the bulk of the disaster control forces entered the area at H+1 and remained in the area one and one-half (1½) hours. It must be assumed that the victims will seek the best cover available when the "take cover" signal is sounded and that they will remain under cover until they are signalled to leave the cover. Since any cover offers some protection from radiation, based on the type cover available throughout the Panama Area, it is estimated that the average cover will offer fifty percent (50%) protection to the victims. With the foregoing in mind, Figure 1 shows that of any group of 300 victims or evacuees who are unfortunate enough to be in a radiologically contaminated area of 400 R/hr (radiation readings calculated to H+1), all will become fatalities even though they may be alive when evacuated. Worse still is the fact that of the 131 disaster control workers assumed to enter the area to remove these victims, 33 will become fatalities and 98 sick because of over-exposure to radiation. The calculations take into account variations of radiation intensities due to movement to and from the area and radiological decay. In the area of 300 R/hr to 100 R/hr some of the evacuees can be expected to live and no fatalities are expected among the disaster control personnel although many will become sick from over-exposure. Finally, of any given 300 evacuees in the 100 to 10 R/hr area, all can be expected to live and none of the disaster control personnel should become sick.

A new technique would be to employ evacuation teams which would enter the area earlier (H+30 minutes) and stay a shorter time (30 minutes). This is based on one mission for the team and a command tolerance dosage of 150 R. Under this technique the evacuees or victims would remain in the area one (1) hour instead of two (2) hours. Figure 1 shows that even under this technique, while 15 of any given 300 personnel evacuated from a 400 R/hr area can be expected to live compared with none before, 13 of the disaster control personnel can be expected to die and 71 will become very sick because of over-exposure to radiation. In both the present and the proposed techniques, therefore, it becomes obvious that it is not practical to deploy disaster control forces into a contaminated area beyond approximately 300 R/hr. It appears that in the area between 300 and 100 R/hr rapid techniques of operation can save a substantial number of victims. For example, Figure 1 shows that for 300/hr, the proposed technique will save twice as many people at about ⅓ the number of casualties to disaster control personnel. The data also illustrates, as to urgency of evacuation, that below 100 R/hr evacuation is necessary but not critical.

The foregoing discussion assumed 131 disaster control personnel entering the radiologically contaminated area. These personnel under present techniques of operation are members of several types of disaster control teams. The teams involved perform radiological survey, firefighting, light rescue, heavy rescue, utilities repair and first aid. In view of the destruction in the area and particularly the radiological hazard, it is not believed to be practical to send these teams into the contaminated area. Rather it must be accepted that in view of the magnitude of the disaster and the radiological hazard involved in the event of surface or sub-surface bursts, fire-fighting, heavy rescue and utilities repair operations must be confined to the fringe areas of the disaster in an effort to contain the disaster in as small an area as possible. From the first aid team viewpoint, the technique of having first aid teams enter a radiologically contaminated area and treat the victims on the scene is too hazardous and time-consuming. Finally, too much time is involved in conducting a radiological survey, plotting this information on a control map and dispatching various teams to the area in series based on calculated "times of stay." The first disaster control personnel that reach the area should be capable of evacuating personnel immediately and at the same time be able to protect themselves from over-exposure to radiation. The time elements of the two techniques described are relative and even if some of the time elements assumed cannot be attained, whenever operations do go into effect more lives will ultimately be saved.

Figure 1

COMPARISON OF TECHNIQUES

PRESENT TECHNIQUE	Radiation In Area (R/hr At H+1)	Evacuees Saved**	Cost In DC Personnel Deaths	Cost In DC Personnel Sick
Assume 300 evacuees remain in area for 2 hours and various disaster control teams totaling 131 personnel enter area at H+1 and stay 1½ hours.*	400	0	33	98
	300	75	0	118
	200	195	0	56
	100	300	0	0
PROPOSED TECHNIQUE Assume 300 evacuees remain in area 1 hour and 4 evacuation teams totaling 84 personnel enter area at H+30 minutes and stay 30 minutes.	400	15	13	71
	300	150	0	42
	200	240	0	17
	100	300	0	0

* Based on observations of Canal Zone JACKPOT Exercises.

** Assumes evacuees take cover, remain under cover and the cover offers 50% protection to radiation.

EVACUATION OF VICTIMS can be accomplished quickly and effectively by evacuation teams. The organization, vehicles, equipment and capability of such an evacuation team is shown in Figure 2. Each disaster control zone should have several evacuation teams. The radiological monitor can perform the functions now done by the ground radiological survey team, control the radiological safety of the evacuation team personnel and save time. Other radiological surveying may be accomplished later by survey teams. Aerial survey is the most effective way of checking downwind fallout, thereby assisting in determining when and in what direction personnel that will be exposed to the fallout should evacuate. The aid men on each team should be medical male personnel, if available, and should limit their first aid to controlling severe bleeding. Time will not allow these personnel to treat fractures, burns or other type injuries. While it is realized that the movement of personnel with fractures that have not been splinted may result in a more serious injury, time is of such a great importance if a serious radiological hazard exists that the risk of further injury must be taken. The victims may be able to overcome physicial injury *or* radiation but few will overcome physical injury *and* radiation. A jeep or command vehicle with a radio will permit control of the team within the zone and control between the team and the zone commander some distance away. The cargo vehicles will give the team the capability of moving victims rapidly from the area. The evacuation signal should be one established for the area and everyone should be trained to recognize this signal. Upon this signal and this signal only, should individuals be taught to leave the cover they took at the "take cover" signal and to join the evacuation team for rapid evacuation from the area. In order to evacuate a *minimum* of 75 personnel per mission, it will be necessary for the team to load as many evacuees or victims as possible on each vehicle. While all possible care should be taken not to injure the victims further, the victims will be required to help each other as much as possible and undergo the ordeal of being packed in the vehicle. This is necessary in view of the time limitations involved in order for evacuation teams to get as many victims as possible out of the area in a single mission.

Figure 2

EVACUATION TEAM PERSONNEL

1 Team Leader
1 Radiological Monitor and Radio Operator
4 Drivers
3 Aid Men
12 Litter-bearers
—
21 Total

VEHICLES

1 Truck, ¼-ton, 4x4, or Similar Vehicle with Radio
3 Trucks, 2½-ton, 6x6 Cargo or Similar Vehicle
—
4 Total

EQUIPMENT

1 Photomultiplier
4 Dosimeters
6 Stretchers
3 First Aid Kits
4 Evacuation Signal Devices

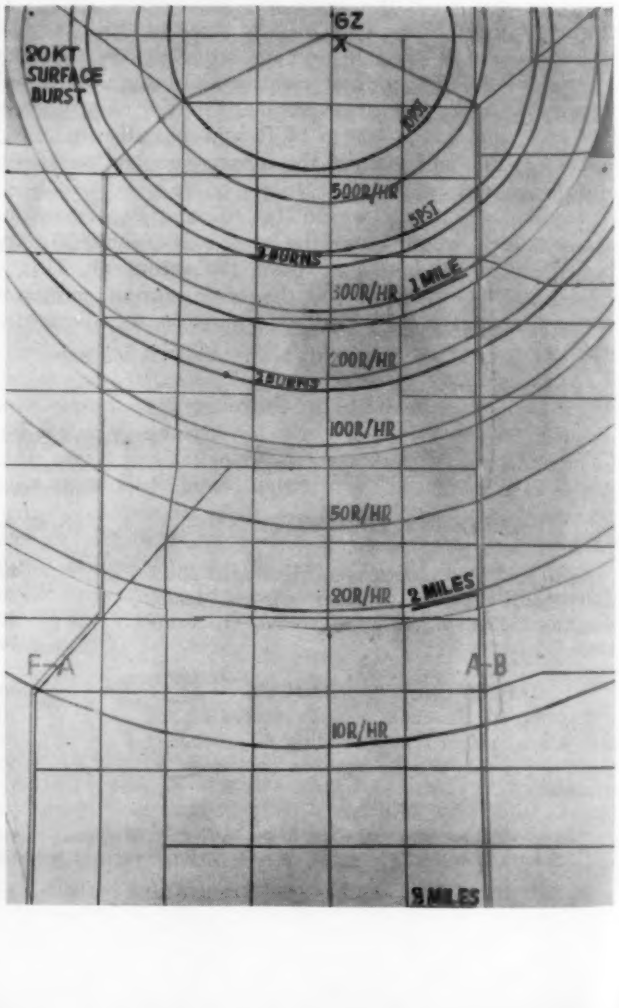
CAPABILITY

Evacuation of **MINIMUM** of 75 Evacuees Per Mission

Perhaps a more important facet of disaster control is the employment of disaster control forces under the proposed techniques referred to in Figure 1, and further touched on under the organization and function of the evacuation team. The technique of operations proposed is illustrated in Figures 3 through 6. Figure 3 depicts any civil community wherein a 20 KT surface burst may have occurred. The area headquarters should establish zones of operation for the surrounding disaster control forces not affected by the burst within minutes after the burst. Such a zone, Zone A, is depiced. As soon as the mobilization signal is sounded, zone commanders should dispatch evacuation teams to the disaster area. The number of teams dispatched will depend upon the size of the zone of operations assigned and a knowledge of the area, routes of entry and expected number of casualties. It is conceivable that these evacuation teams might be dispatched even before the zone has been assigned, the evacuation teams being informed by radio while en route, of the zone of operations by the zone commander. The important point is that the evacuation teams should move out as quickly as possible.

FIGURE 3 ALSO indicates the limits of significant amounts of heat, blast and residual radiation in a sector of the disaster area as caused by a 20 KT surface burst. The radiological hazard following a surface burst will extend considerably beyond the limits of significant damage caused by blast and heat. While the limits of effects will vary for every situation depending on the size and number of weapons employed, the height of burst, the weather, the terrain and the type target involved, the principles apply to every situation.

Figure 3



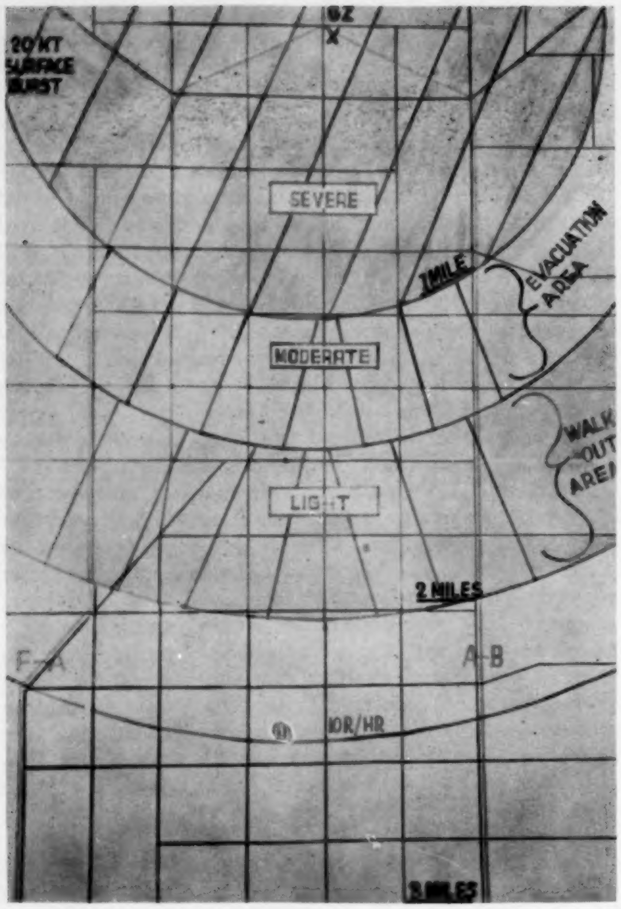


Figure 4

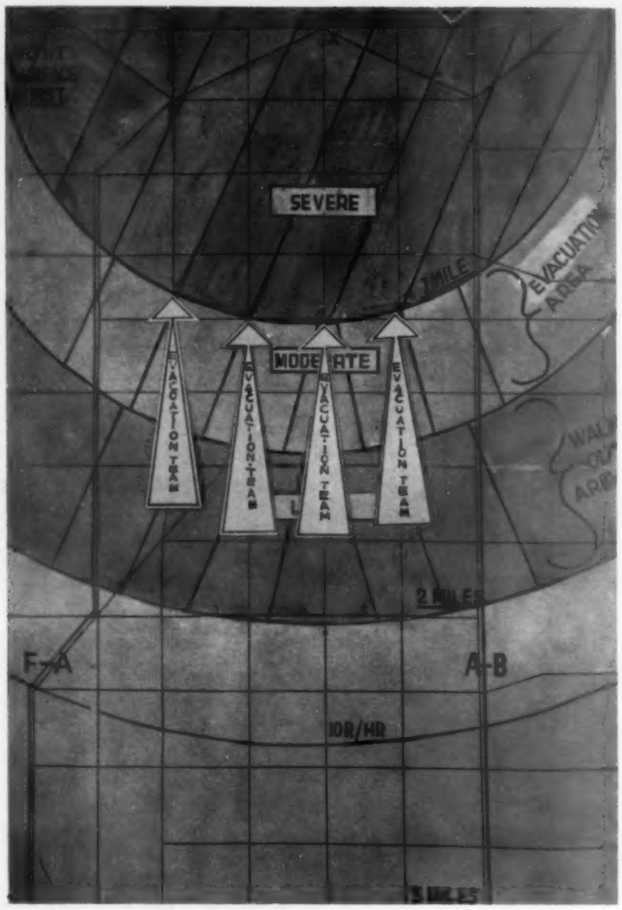


Figure 5

Because of extensive blast damage, great quantities of heat damage to exposed personnel and serious radiological contamination within the area generally outlined by the 300 R/hr line, this area, from the personnel viewpoint can be designated as an area of severe damage. Figure 4 depicts this area. Few of the personnel in this area have a chance of survival. The principal exception will apply to those individuals who were fortunate enough to get cover which will offer almost complete protection from radiation. Aside from the fact that personnel without good cover have little chance of survival in this area, particularly if they leave their cover, there is the futility of sending disaster control forces into this area as illustrated by Figure 1.

The area roughly between the 300 R/hr line and the 100 R/hr line is an area which may be described as a moderate damage area as far as personnel casualties are concerned (Figure 4). Some of the personnel in this area may be injured by blast and some will be injured by heat but the primary concern to personnel will again be radiation. This area can be termed an "evacuation area" or perhaps called a critical "fringe area." For any large disaster there is always an area around it where personnel, though severely injured, can be saved though prompt, effective action. This is especially true in the case of disaster control where a radiological hazard exists. This "evacuation area" is the area that requires the immediate attention of the disaster control forces.

Figure 4 also depicts the light damage area. Casualties to personnel in this area will be almost exclusively from radiation. While evacuation must be accomplished, it is not nearly as critical as in the case of the moderate damage area. Personnel in this area should, generally speaking, be able to help themselves and when notified to evacuate can either walk or ride in either their own or other transportation out of the area.

Operationally, the evacuation teams should proceed to the disaster area and, within the zone sector assigned by area headquarters and the sub-sector determined by the zone commander, simultaneously penetrate toward ground zero (Figure 5). The evacuation team must, at this point, determine whether or not a radiation hazard exists. If no radiation hazard exists, the evacuation team should proceed as close to ground zero as possible and begin evacuating casualties. In this situation the zone commander should plan to move his other disaster control forces well forward into the disaster area. They should organize outside the area of serious structural damage yet as near the severe casualties as possible. Organization of the forces can be the same as for a radiological situation. If radiation is encountered, the evacuation teams should report the coordinates of the 10 R/hr line (calculated to H+1). This becomes an important control line. In this situation, the zone commander plans to organize his remaining forces behind the 10 R/hr line. In the meantime, the evacuation teams proceed directly to the 300 R/hr line. When the evacuation team reaches the 300 R/hr line, the team then turns around and picks up casualties as it proceeds from the 300 R/hr line to approximately the 100 R/hr line. In order for the victims or evacuees to know when to leave their cover, the evacuation teams sound a prearranged signal indicating to the evacuees that they are

(Continued on Page 18)

AMERICAN PATENT INCENTIVE SYSTEM

Spur to Progress of Useful Arts

The Patent Incentive System—Its Origin, Purpose and General Operation, Including Some References to Procedures of the United States Patent Office in Considering Patent Applications.

(EDITOR'S NOTE—*This paper was prepared by a professional group in Washington, D.C., concerned with patents. It is published as a matter of general interest.)*

PATENTS for inventions have been granted in one form or another since about 1400. Patents were granted in Venice, Italy, as early as this date. Patents or exclusive rights were granted at even earlier dates in Greece to cooks having developed special recipes. All cultured countries have had and do have patent incentive systems, the basis of which is the exclusive right to make, use, or sell the invention or to exclude others therefrom, depending on the wording of the statutes of the particular country and their interpretation. Early in this country the various states granted patents to their citizens. However, since the adoption of the Constitution and the enactment of the patent laws thereunder, only Federal Government granted patents for inventions are obtained.

The U.S. Constitution, adopted by the U.S. Congress, March 4, 1789, includes among the powers granted to Congress, Article I, Section 8 Clause 8, which reads as follows:

> "The Congress shall have the power . . . to promote the progress of science and the useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

The incentive of the "exclusive right," i.e., the right to exclude others from the area of the patented invention or discovery, that is the right to exclude others from making, using or selling the patented invention is clearly spelled out in the constitutional provision. This incentive, hope or reward, or encouragement, which can be gained for said "limited times" has caused inventors and discoverers and their financial backers to expend the time, energy and funds to develop and to produce their inventions, etc., and to avail themselves of the protection of patent. This, of course, has resulted in disclosure of their brainchild to the public by a description of it, in a patent document, usually with examples, which can be easily followed by anyone versed in the field to which it relates. This is obtained following an examination of a written application for patent in the United States Patent Office in Washington, D.C.

It is interesting to note that George Washington, speaking to Congress in January, 1790, said:

> "I cannot forbear intimating to you the expediency of giving effectual encouragement, as well to the introduction of new and useful inventions from abroad, as to the exertions of skill and genius in producing them at home."

Thomas Jefferson, Secretary of State, together with Henry Knox, Secretary of War, and Edmund Randolph, Attorney General, formed the first Patent Office. During his tenure in office Thomas Jefferson wrote:

> "An act of Congress authorizing the issuing of patents for new discoveries has given a spring to invention beyond my conception."

Also, Abraham Lincoln, speaking of the Patent System, stated:

> "The patent system added the fuel of interest to the fire of genius."

PATENTS granted under the Patent System form a huge body of scientific and other information, mainly of technological character, in which can be found solutions to daily technological problems and suggestions for further developments along widely different lines. Over 2,800,000 patents have been granted to people in this country and to applicants from abroad. Last year approximately 47,000 patents were issued. In the last ten years 363,000 patents were issued, demonstrating the worth of the system. These patents relate to the mechanical, electronic, chemical, building, and other arts, as well as to certain types of plants and to ornamental designs, which fields are represented by many of the machines, such as automobiles and automotive devices and gadgets used by mechanics and housewives, etc., television, telephone, radio, and chemical compositions of matter which are useful in the various arts and sciences including those useful in treating humans and their domesticated or other animals.

Since the first patent statutes were enacted in the 1790's, there have been made only a few serious or basic changes. Indeed, only a few reviews or rewritings of the statutes have been effected. The present patent code became effective January 1953 and includes variations and modifications, which result from a host of court decisions made in the past many dozens of years. Also representatives of the learned societies concerned with the application of the patent laws and the practice thereunder, as well as people in the Patent Office, who have the duty of examining applications for and granting of patents, and their supervisors, have contributed markedly to the new Patent Code which basically did not change the general law of patents.

Patents relating to atomic energy are now also issued. These are granted subject to certain restrictions set forth in the laws pertaining to atomic energy, which is still a government-controlled development.

The laws which have been passed pursuant to the constitutional empowerment recognize that the best manner of causing people to devote their efforts to the progress of the useful arts by research and development or otherwise to bring into being new inventions or to tell the people of inventions which have occurred to them or have been discovered by them is to provide such people with a species of protection permitting them to enjoy the fruits of their inventions for a period of time to the exclusion of all others, if they see fit to exclude

them, who might otherwise appropriate to themselves to the disadvantage of the inventors or discoverers, the fruits of the inventions or discoveries of said inventors or discoverers.

The exclusionary right of the patentee which is practiced by enforcement of the patent in a court provides a powerful incentive to those who would produce inventions or discoveries, to those who would finance said inventions or discoveries or development of the same and to others otherwise connected therewith because exclusionary rights for a period of time permits the earning back, so to speak, usually with a profit of the labor and time and money which have resulted in the said invention or discovery. Thus, the limited franchise, i.e., the patent right, which the government grants under the patent laws, is beneficial to the public at large because it secures to the public a disclosure of the invention or discovery and how to practice the same. After the expiration of the patent anyone can follow and put into practice, to his own profit, the teachings and disclosures thereof. Even while the patent is running toward its expiration date, interested parties can apply its disclosures to the fuller advancement of research effort.

A mere idea or concept is not patentable. Patents are granted only for inventions in concrete form. Thus, a process, which can be defined as a series of steps performed upon a material or with several materials yielding a result, is patentable if it is new and has involved the exercise of more than mere skill by a person versed in the art to which the process relates or with which it is most nearly connected. A method of doing business is not patentable. Physicians' prescriptions are not patentable. However, an otherwise patentable compound or composition of matter will not be held unpatentable simply because it finds utility in the treatment of the human body. Ordinarily, methods for treating the human body are not patentable. So-called "patent medicines" may contain ingredients which are protected by patent. Or, the composition may indeed be a patented one. However, not all "patent medicines" are protected by patent.

It is interesting to note that the name "Letters Patent" in the original form in which it was used means "open letters."

TO OBTAIN a valid patent, it is necessary that the invention has not been described in a printed publication or been in public use or on sale before the invention was made or for more than one year prior to filing of the application for the patent.

Sometimes it happens that two or more applications for patent claim substantially the same subject matter or that an application is filed claiming subject matter already claimed in an issued patent. Under certain circumstances, a so-called "interference proceeding" is initiated in the Patent Office to determine which of the several inventors is truly the "first" inventor within the concepts of the Patent Law. Interference proceedings are quite complicated and are beyond the scope of this paper.

When an application for patent is filed in the United States Patent Office, it is examined and a decision as to patentability is made by an examiner in the Patent Office. The Patent Office comprises a corps of about 1,000 examiners and ancillary personnel. There are approximately 70 examining divisions, including a division which is devoted solely to the proper classification of the patents according to their subject matter. An examiner qualifies for his position by accomplishing certain technical training of college level in the particular field, electronic, mechanical, or chemical, in which he is engaged to examine patent applications. He is also trained to a full understanding of the patent laws and the rules governing the practice within the United States Patent Office, under which patents are granted. When a patent application is examined, the examiner searches through it for the essence or inventive concept and then determines whether the "claims" which are appended to the end of the description of the invention sufficiently point out and distinctly delineate the area from which the patent holder will be given the right, if a patent is issued to him, to exclude others. The right or grant of the patent is delineated or determined by the patent claim as it is read in the light of the written description and pertinent general art, such as prior patents or publications, which may be pertinent to the subject matter of the claims. Usually, although inventors are permitted to prosecute their own inventions, patent lawyers or agents are employed by inventors to prosecute patent applications for them. A patent lawyer or agent is usually a person who is trained in the particular art to which the invention relates as well as in the patent practice. The Patent Office does not distinguish between patent lawyers and patent agents, as far as practice before it goes. Ordinarily, a patent agent is a person who is not a member of the legal bar, although he may sometimes have legal training. Many examiners and other personnel in the Patent Office are members of the bar or are studying for membership in the legal bar. The Patent Office examining corps is supplemented by a staff of administrative officers and legal counsel or law examiners, who assist the examiners in their functions of determining the highly intricate questions of technology and law as well as practice which can arise, or do arise, in the prosecution of a great many patent applications. Also, in the Patent Office there is a Board of Appeals, which decides issues on which the patent examiner and patent lawyer or agent have been unable to reach agreement. Thus, when a patent lawyer or agent is dissatisfied with the so-called primary examiner's determination of patentability or other issues in a patent application, he can, upon payment of a nominal fee, appear before the Board of Appeals to argue his case, submitting a brief of the points and authorities on which he will rely.

ALSO, THERE is a Board of Patent Interference Examiners, who determine issues of priority of invention among two or more applicants and/or patentees who may be claiming substantially the same subject matter, as noted earlier. An interference can be instituted either by the examiner when he notices that an applicant is claiming the same invention as is being claimed by another applicant or has been claimed in a patent, or such a proceeding can be commenced by an applicant by simply copying, within one year after it has issued, the claims of any patent which appears to cover an invention which the applicant believes himself to have earlier invented.

When the invention or discovery which is submitted in written form with a drawing, if one is possible to be drawn based upon the nature of the invention or discovery, is examined, the examiners search the prior knowledge as it may be recorded in earlier patents or in publications. The examiner then makes a decision as to whether a patent shall be granted. Thus, a patent is a document in which a description of the invention is set forth and in which there are certain claims written defining the areas from which the public is to be excluded for a period of time which, as stated, is limited. It will be noted that the area from which the public is

excluded is a new area. It has not heretofore existed. Therefore, the exclusion is not one which operates as would an exclusion from an area which the public heretofore had a right to enter. Therefore, the patent properly granted takes nothing away from the public.

The patent is granted for a period of 17 years from its date of issue. A patent does not grant to the holder or owner any right to make, use or sell the patented invention or discovery since it is often the case that an earlier patent will dominate a later patent which may be for an improvement of the invention of the dominating patent. Also, certain state or local laws may prohibit certain uses of patented inventions, i.e., pinball machines when used for gambling.

When the patent is granted, it is printed and is available in several libraries throughout the country and indeed throughout the world. One place in which patents are classified according to subdivisions of principal heads of subject matter is the search room in the Patent Office, in Washington. Here all of the patents which have been granted can be searched by anyone to determine just what is old and what is new in the art. Anyone can go to the search room to find out whether or not his invention or discovery is novel and worthy of a patent. Usually, however, it is preferable to have this done by an experienced person who will be able to find all of the pertinent places to search in the thousands of subclassifications which now exist. Also, patent disclosures require a knowledge of patent law and technology related to them to determine their teachings.

The classification of patents is an effort which is continually being made and which involves a great deal of time and money. Efforts are now under way to simplify classification and searching of patents. Mechanical searching in one art has been accomplished.

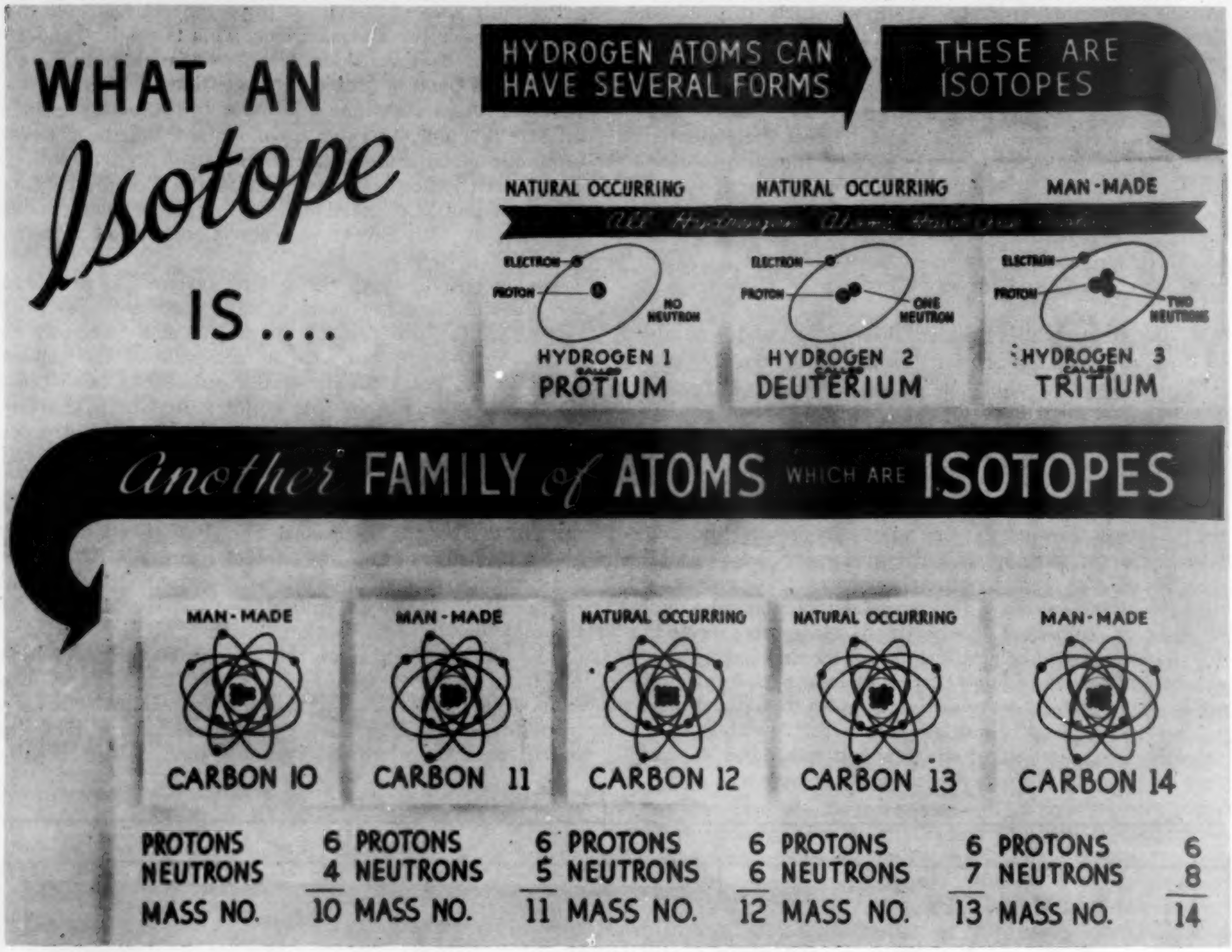
Probably one of the most important bureaus of the government is the Patent Office. This is readily understood when it is considered that the examination and granting of patents protecting inventions sparks the investment of capital, time and labor to promote the useful arts through the rapid development and the general economic advancement of the industries of our nation. The Patent Office is located within the Commerce Department and is situated in the Commerce Department Building at 14th Street between Constitution Avenue and E Streets, Washington, D. C.

The incentive which the patent system has provided for investors and inventors to sally forth into the promoting of the progress of the useful arts naturally to their own benefit but also as a result of the patent grant to the great benefit of the public has been phenomenal, especially in this country in which the advancement of the gasoline engine, airplanes, electronics and now even atomic developments have been fostered by the said system.

The annual operating budget of the Patent Office is presently about $17,000,000. The Patent Office earns about 40% of its operating budget from fees. There are some people who believe that the Patent Office should be operated wholly at government expense in view of the fact that the information, which is obtained by way of the patent grant and the encouragement which is given by way of said grant, benefits all. There are others who believe that those who primarily benefit from the grant of a patent are those who obtain the patent and, therefore, they should pay at least a sub-

(Continued on Page 30)

The reader, as he starts this article, may find it useful to examine this chart designated as Figure 8 and referred to among the illustrations herein in that numerical order. It shows for two of the families of atoms, the structural differences between the natural occurring types or isotopes and the man-made types or isotopes which are radioactive. It is the latter called radioisotopes, with which the article deals.—Ed.



INDUSTRY'S NEW "GENII"—THE RADIOISOTOPES

By Earle J. (Jack) Townsend*

Industrial Information Branch
Atomic Energy Commission

As you picked up this copy of the Journal and started thumbing through its pages, was there a pause as you lit a cigarette?

That cigarette is a representative example of what a new industrial "tool"—the radioisotope—means to you, and to industry itself. You, as an individual, are getting a more uniform quality product. The cigarette industry, over all, is saving between $42 and $57 million annually through more efficient production as radioisotopes carefully control the amount of tobacco going into cigarettes. (Figure 1)

*The author, a Major in the U.S. Army Chemical Corps Reserve, is well known to members of the Armed Forces Chemical Association. As Public Information Officer for the Office of the Chief Chemical Officer, Washington, D. C. and later as Field Public Information Representative for the Chief's office, he was a frequent contributor to the AFCA Journal. In March 1957, he was voluntarily released from active duty to join the Division of Information Services of the AEC's Washington headquarters. The Commission's new Industrial Information Branch has been formed to keep industry abreast of nuclear energy information as a means of promoting the peaceful uses of atomic energy.

Illustrations from AEC

The story is the same throughout American industry. Wherever radioisotopes are being used, savings in time and money, better and more uniform products are the result. Industry, as a whole, is effecting savings estimated at more than one-third of a billion dollars a year; agriculture is adding another $200 million or more in annual savings.

Radioisotopes are fitting into the industrial picture everywhere.

The cesium-137 radioisotope is being used routinely to measure the density of whiskey from distillery evaporators; cobalt-60 is paving the way toward new food preservation methods; promethium-147 powers a dime-size battery for use in wrist watches; strontium-90 is measuring the coating weight applied to cloth and paper backing materials; scandium-46 traced the dispersal of Los Angeles sewage dumped in the Pacific Ocean; iridium-192 is detecting hidden flaws in valve castings; thallium-204 may have been used to control the thickness of the paper on which this page is printed; radioactive krypton gas is providing illumination in a mine, marine, or industrial colored safety marker lamp which is visible at 500 yards; and so on, ad infinitum.

Twenty years ago, the radioisotope was a scientific curiosity. Today, it is a small, benevolent "genie" saving raw materials, cutting processing time, doing jobs easier, producing better and more uniform products, and adding to the profit side of the ledger in every-day manufacturing processes and through research use. Radioisotopes are repaying the nation's investment in the atomic energy program; and ever-wider beneficial returns will be realized as more and more uses are found by more and more users.

Although isotope research is leading to many new products, the major benefits to date have been of the type Benjamin Franklin referred to when he worte, "A penny saved is a penny earned," in his Poor Richard's Almanac nearly two centuries ago.

If, for instance, one or two cents can be saved on each ton of coal sorted and processed by the mining industry, the savings soon mount in thousands of dollars—and radioisotopes are doing just this. (Figure 2) Or, as one oil firm found out, radioisotope tracers used in researching and developing a new lubricant achieved results in four years at a cost of $30,000 as against the estimated 60 years and $1 million which would have been required by the older, more conventional methods. Just as important also, is the fact that the new lubricant became available 56 years sooner, thereby reaping additional benefits to the producer and consumer alike.

Industrial use of the radioisotope is still in its "infancy." Only a relatively few of the more than 900 known radioisotopes are being utilized. Only a fraction —estimated to be about one-third of one percent—of the nation's manufacturing and processing organizations have put these tiny bits of nuclear energy to work. Even though the radioisotope is being used in nearly a thousand different ways, the unborn uses are probably double or triple that number.

In a general sense, no manufacturing firm is too big or too small to profit from radioisotope use in its business.

As Oscar Bizzell, a radioisotope development expert with the Atomic Energy Commission's Division of Civilian Application pointed out to the writer, "I, or anyone with a fair knowledge of radioisotopes, could walk through most any plant and point out lots of places where the isotope could be used with good results. The average plant manager has little conception of what radioisotopes can do for his operations in the way of speeding up a job or cutting corners on costs. It is important that he learn as soon as possible."

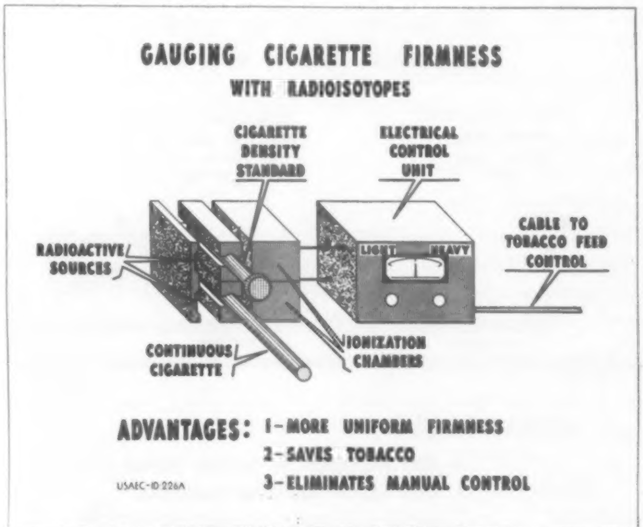


Figure 1

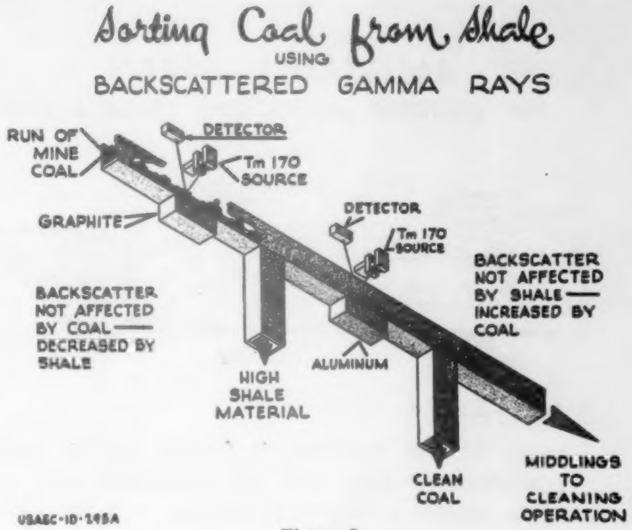


Figure 2

When man learned to take naturally-stable atoms and make them artificially radioactive, he created one of the most useful tools yet available to research and technology. The tell-tale "sparks" given off by radioisotopes makes them ideal tracer agents, since it is possible to detect them in minute concentrations which are beyond the limit of detection with the use of ordinary chemical assay methods. The ability of these "sparks" to penetrate, or bounce off, materials makes them useful as gaging devices and in detecting flaws. These radioactive "sparks" also make them useful as catalytic "triggering" agents for chemical processes.

For instance, the value of this "triggering" action was well demonstrated a few months ago when the first basic change in "curing" rubber was announced since the discovery of vulcanization in 1839. In conventional vulcanization, sulphur and other chemicals are added to rubber and heated to more than 300°F., realigning the molecules to provide greater resistance against temperature changes and deterioration. In this process, carbon atoms are linked through sulphur atoms which is considered a "weak link." However, a tire manufacturer has found that heatless vulcanization of rubber can take place through use of radioactivity. Irradiation with gamma rays results in direct linkage of the carbon atom chains in the rubber molecules, producing a rubber that wears longer and resists deterioration better than heat-vulcanized rubber.

Radioisotope gages are one of the most general industrial utilizations of radioactivity, being used for such things as measuring and controlling the thickness of sheet and strip materials—such as adhesive tapes; controlling the density of products—cigarettes for example; and measuring the levels of liquids in closed containers.

The principle of such gages is that the amount of radioactivity penetrating a material will fluctuate as the thickness of the material fluctuates. When a material is passed between an isotope source and a detector, the strength of radiation penetrating the material shows on the detector and can be used to control the process, either manually or through electronic servomechanisms. In some cases, where a film of material is being applied to another material, the amount of radiation being reflected (back scatter) will be used to operate the detector. (Figure 3) Neither type of gage requires physical contact with the material, and they can operate continuously, making it unnecessary to stop the production line while test samples of the product are taken.

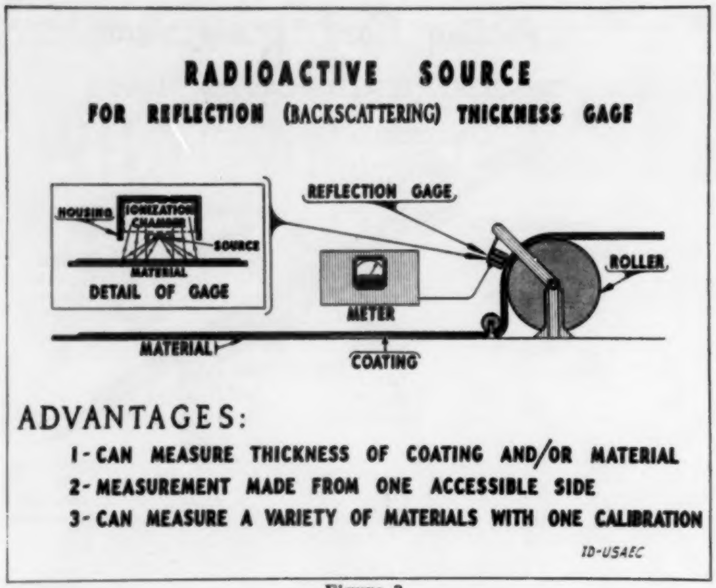


Figure 3

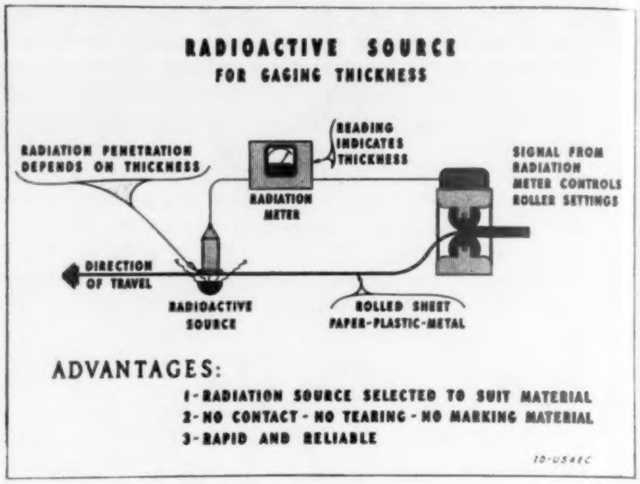


Figure 4

The results of industrial use of such gages are generally the same—economy of time, materials, and man-power. For example, with beta-type gages controlling the thickness of the product, a copper rolling mill can turn out eight one-ton rolls of copper sheeting in two hours. Using hand calibration, or contact gages, the job takes about eight hours. Besides the six-hour economy of time and man-power, the isotope-controlled gages save several hundred pounds of raw materials and scrap from the closer tolerance obtained, and produce a more uniform quality product. (Figure 4)

The utility of radioisotopes as tracer agents stems from the fact that they can be used in minute form—millions of times smaller than tracers detectable by chemical means—and still be detected by their radiation despite intervening structures or material and without operational stoppage for sampling. Their use covers a wide range, such as tracing materials in complex piping, detecting underground (Figure 5) or heat-exchanger leaks, ascertaining proper mixing of two or more ingredients, measuring the efficiency of cleansing agents—and so on, through more than a dozen use-categories.

They are particularly useful for routine plant control of catalyst circulation in a chemical manufacturing process—or in a catalytic cracking refinery.

In the latter situation, as an example, a major oil refinery introduced isotope tracer techniques with somewhat dramatic and useful results. Normally, the flow of the bead-type catalyst is followed by the temperature surges measured at several places in the cracking tower as the catalyst passes down the cracker into the furnace—where the accumulated carbon is burned off—and back to the top of the cracker. This method requires two man-days and does not give completely dependable results. The refinery impregnated a few of the catalytic beads with zirconium-95 and placed radiation detectors at each end of the pipe between the gas lift and the cracker. Knowing the weight of the catalyst in the pipe and measuring the time interval between two peak radiation readings, an operator can quickly calculate the catalyst circulation weight in tons per hour. In its first large-scale application, this simple method eliminated the necessity for a $100,000 shutdown of the refinery when it showed a malfunction of the circulation system as soon as it started. The old method probably would not have shown the malfunction in time to prevent a breakdown.

Basically, radioisotope utilization can be classified under three general areas: detectability (tracer agents, wear studies, etc.); for the effect materials have upon radiation (radiographic inspection, thickness and density gages, etc.); and the effect isotopes have upon materials (activation of chemical reactions, ionization, sterilization, etc.).

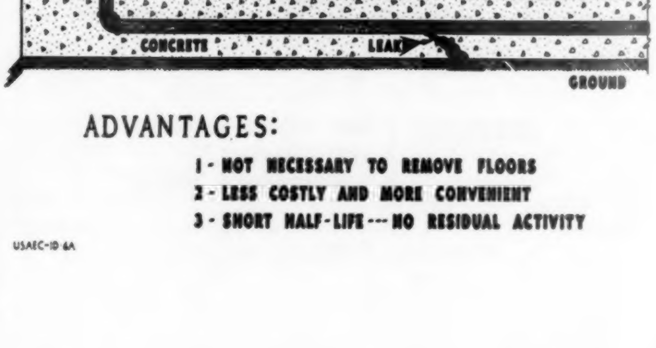
Two factors generally control the utilization of a specific radioisotope for a particular type of job: the kind of energy emission, and the isotope's half-life.

Radioisotopes emit three kinds of energy: alpha radiation, relatively large particles having a low penetration power—a thick sheet of paper will stop them; beta radiation, particles smaller than alpha's and with a somewhat greater penetration power—such as up to a few millimeters of aluminum; and gamma rays which are energy waves similar to the familiar x-ray, and which will penetrate several inches of lead or concrete. Each radioisotope has its own particular form of emission, giving off only one or any combination of alpha, beta, and gamma energies, in varying strengths.

A radioisotope such as polonium-210, which gives off only strong alpha radiation, can be used for ionization

(Continued on Page 20)

Figure 5



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Polyamines • Soda Ash • Sodium Chlorite Products • Sodium Methylate • Sulfate of Alumina • Sulfur (Processed) • Sulfuric Acid

DISASTER CONTROL

(Continued from Page 10)

to come to the evacuation vehicles. Here, because time is so critical, victims must be trained to help each other to the maximum extent possible. Self-aid and first aid to fellow victims are a must. As many people as possible must be loaded on the evacuation vehicles in as short time as possible. Time will not permit evacuation team personnel to make a detailed search of buildings for victims.

While the evacuation teams are performing their mission in the disaster area, the zone commander moves the remainder of his forces to the disaster area and establishes traffic control points, decontamination points, first aid areas and reserve forces areas beyond the 10 R/hr line as depicted in Figure 6. Organizing the balance of the disaster control forces beyond the 10 R/hr line permits these personnel to work wihout fear of radiation. All teams can be easily controlled. First aid teams can be established in areas and use "assembly line" techniques thereby increasing efficiency. Re-supply of decontamination and first aid teams will be a simple matter. A matter critical to the first aid teams is the fact that these are usually distaff personnel and the success of the operation in time of real emergency hinges on whether or not these women will then "volunteer" for duty. Since practically all of the distaff workers have children of their own, it would appear that the chances of having them volunteer in a real emergency would be much greater if they were assured that they would be employed in such a manner that they would not become casualties due to radiation and would, therefore, be able to return to their families after their work has been completed.

Finally, as depicted in Figure 6, the evacuees, regardless of their mode of travel from the area, are directed toward the traffic control points which in effect constitute a straggler line. From this point the personnel are directed to the decontamination stations and then to first aid, refugee or to other areas depending on their condition or category. Even if casualties arrive beyond the 10 R/hr line before the first aid teams arrive the individual is better off to await first aid out of the radiologically contaminated area than in it.

In summary, the new technique of operations described above consists of bringing the victims to the first aid personnel rather than sending the first aid personnel to the victims. In the final analysis it will save the lives of personnel having a chance of being saved and will not compound the problem by adding unnecessary casualties to the total from personnel that escaped the initial effects. The procedure is based on a realistic, practical approach to the basic facts of the problem and offers a rapid, simple plan that will result in effective disaster control.

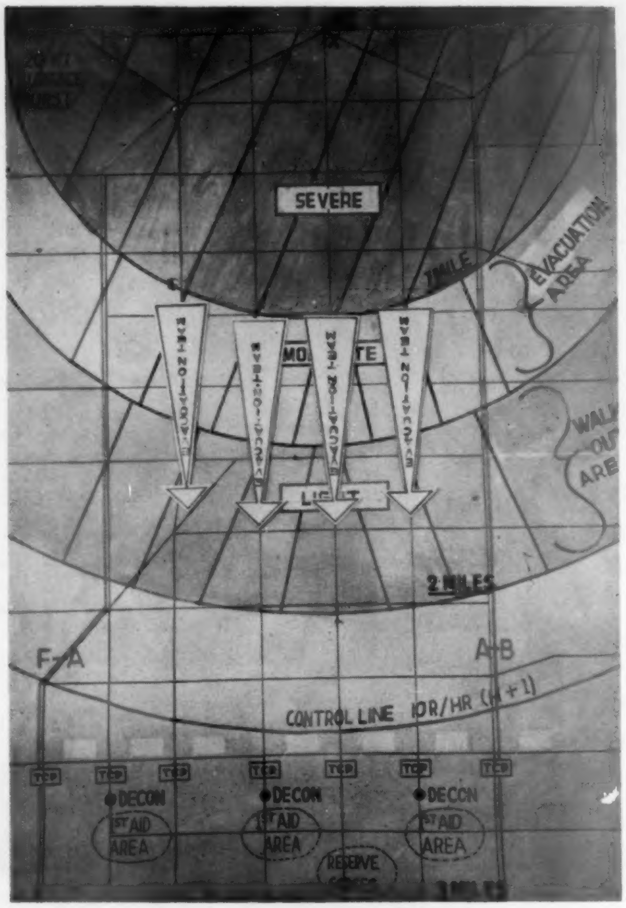

Figure 6

ARMY SEEKS 200 SCIENTISTS FOR REGULAR COMMISSIONS

The Army has launched "Project 200," a program to select and commission in the Regular Service 200 scientists from civil life. The plan provides for advanced grades ranging from lieutenant to lieutenant-colonel, and advanced standing for promotion in accordance with certain criteria as to professional experience, age and previous military service.

The program is to give effect to a special provision of Public Law 737 of the 84th Congress, the "Armed Forces Regular Officer Augmentation Act of 1956." The appointment of these specialists, who will be assigned to appropriate technical services, must be completed by July 20, 1958. A candidate must meet one of the three professional qualifications: (1) have a doctor's degree or (2) have a masters degree and three years postgraduate experience in his specialty, or (3) have a bachelor's degree and five years postgraduate experience.

The President has authorized appointments in the following engineering fields: Aeronautical, Chemical, Civil, Communications, Electrical, Electronic, Mechanical and Nuclear Effects Engineering; and in the following sciences, or scientific occupations: Bacteriology, Chemistry, Electronic Data Processing, Guided Missiles, Health Physics or Radio Biology, Hydrology, Mathematics, Meteorology, Nuclear Physics, Operations Research, Physics and Psycho-physiology.

Detailed information of the project may be obtained by writing to the Adjutant General, Department of the Army, Washington 25, D.C., Attention: AGPB-R.

SUBENGINEERING COURSES FOR VETERANS UNDER G.I. BILL

The Veterans Administration recently announced a new kind of apprentice training, approved for Korea veterans which, it states, may hold hope of adding urgently-needed engineering talent to American industry.

The new program, leading to a job objective of "engineering technician," will train veterans for some of the more routine tasks in engineering—thus allowing full-fledged graduate engineers to concentrate in advanced work.

Approved by VA for veterans employed by the General Electric Company as apprentice trainees, the spe-

cial apprenticeship consists of "learn while you work" training on-the-job plus two years of regular credit-earning college courses in the evening—all in various phases of engineering.

Veterans entering this apprentice program must meet all qualifications necessary to enter college. Their two years of evening classroom work will count toward an engineering degree, should they wish to continue their studies later.

The job training portion of the course includes engineering design, drafting, and machine shop.

Throughout the program, veterans will receive apprentice wages, stepped up periodically, as well as monthly Korean GI Bill training allowances.

Normally, VA explained, the States approve courses for veterans under the Korean GI Bill. But when a course is to be offered in more than one State—as is the case with General Electric—VA itself has authority to handle GI approval.

STUDENTS FROM 21 FOREIGN NATIONS TO TAKE AEC COURSE

The U. S. Atomic Energy Commission has accepted 62 scientists and engineers, 50 of them from 21 foreign countries, for enrollment in the Sixth Session of the Commission's International School of Nuclear Science and Engineering at the Argonne National Laboratory, Lemont, Illinois. The training, part of the President's "Atoms-for-Peace" program, is shared by the International School and cooperating universities, North Carolina State College and Pennsylvania State University.

The enrollment brings to 355 the number pursuing the course in unclassified reactor technology. Of these, 267 have come from 42 foreign countries. The 88 American students have been sponsored largely by United States firms interested in nuclear energy.

A student from Afghanistan is the first-time representative for his country. Other nations represented in the tentative roster of the Sixth Session Class include; Austria, Brazil, Burma, Nationalist China, France, Germany, Greece, India, Indonesia, Israel, Italy, Japan, Korea, Mexico, Netherlands, Pakistan, Peru, Spain, Switzerland, and Thailand.

ENLISTED PERSONNEL BENEFIT ASSOCIATION IS FORMED

WASHINGTON, D.C.—A non-profit Association open to "Regular" enlisted personnel has been organized, it was announced recently by First Lieutenant Thomas D. Conrad, Secretary-Treasurer of the Association.

The Association was formed by a group of senior enlisted men stationed in and near the Pentagon. Created to advance the economic interests of service men and women, it will initially offer its members emergency loan privileges, scholarship grants to deserving children of members, and low-cost group life insurance.

Lieutenant Conrad stated that all officers, directors and advisors will serve without compensation. The Board of Directors, composed of enlisted personnel, will be elected annually by the members.

Major General Robert S. Moore, USA, Retired, has consented to act as Advisor to the Association, without compensation.

The Association's address is 422 Washington Building, Washington 5, D.C.

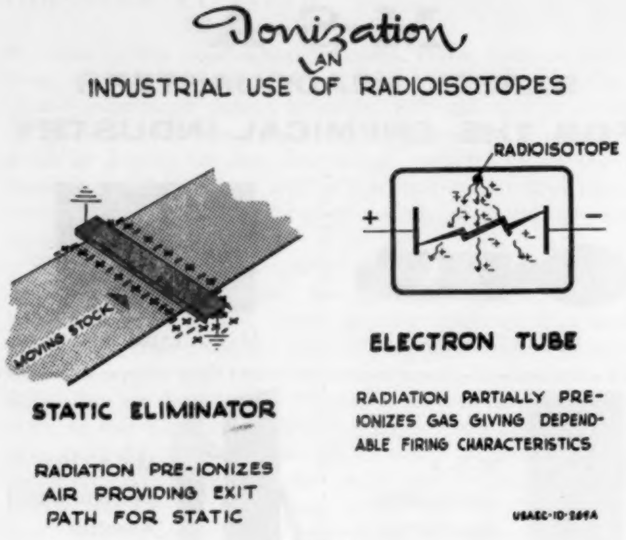

Figure 6

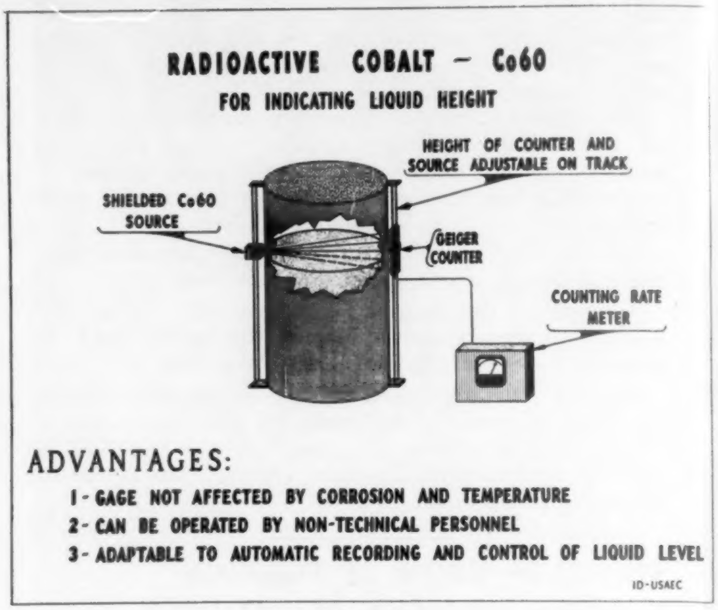

Figure 7

RADIOISOTOPES

(Continued from Page 16)

purposes, such as removal of static electricity during the paper-making process. (Figure 6) A strong beta emitter, with no alpha or gamma emission, such as strontium-90 can be used for measuring and controlling the thickness of aluminum foil; and cobalt-60, which is a weak beta emitter but has strong gamma energy, can be used in radiographic testing of metal castings or weldings.

The second factor, the half-life of a radioisotope, is the time it takes for a given amount to decay to one-half its initial value—periods of time ranging from fractions of seconds to thousands of years. For instance, a radioisotope with a two-day half-life, such as antimony-122, will lose 50% of its initial radioactivity in the first two days. In the next two days, the remaining radioactivity will again be reduced by 50%—down to 25% of its initial value. This process continues until the radioisotope becames relatively stable.

This half-life factor is taken into account when considering the job to be done by a particular radioisotope in the interests of economy and to minimize any potential health hazard. For example, the flow of currents near a Lake Michigan industrial area were being studied during 1955 in connection with a waste disposal problem. The isotope chosen as a tracer material was phosphorus-32, which has a 14-day half-life. Since the study could be conducted in a relatively short time a longer half-life isotope was not necessary. The shorter half-life radioisotope resulted in quicker disappearance of lingering radioactivity.

On the other hand, a 14-day half-life radioisotope would hardly be economical in a set of gages such as used to control the level of strong chromic acid inside a glass-lined evaporator ten feet in diameter—the isotope source in the gages would have to be replaced too frequently. In such a situation, an industrial firm found that cobalt-60, 5.3-year half-life, was most economical in keeping the level of this highly-corrosive liquid within one-fourth inch of the desired volume over a long operational period. The gages were a part of an automatic-recording, flow-control mechanism. (Figure 7)

The combinations of types of radioactivity and strengths, and the wide range of half-lives, give radioisotopes such a versatility that there seems to be an endless number of uses to which they can be put—uses bound only by man's ingenuity. The radioisotope represents our most important, peaceful use of atomic energy yet achieved. It is already having a marked effect upon the nation's economy and welfare, yet its full potentialities and utilizations have barely been recognized. Its immediate applications, those foreseen for the future, and those not yet foreseen, will probably outstrip the benefits to be obtained from nuclear-generated electricity and propulsion—uses of atomic energy still in the formative stage.

As Atomic Energy Commissioner Dr. Willard F. Libby recently pointed out in a Hazleton, Pa., speech, ". . . Within three to five years . . . isotopes will be paying the whole way for the atom, and the American people and the Western World will get their atomic armaments and their atomic power development costs all free—in the sense that the benefits of $5 billion annual savings in industrial processing and agricultural costs are pretty well distributed among the tax payers so that the Atomic Energy Commission budget can be offset against these savings for a direct outlay of about $3 million annually. Isotopes are giving a fair return on the total investment of the whole Atomic Energy project; and our nuclear weapons stockpile and the atomic power developments, costly as they are, are beginning to be borne by the largely unsung but very benevolent isotopes."

EARLY THIS year, it was pointed out to a Congressional committee by Admiral Lewis Strauss, Chairman of the Atomic Energy Commission, that industry alone is saving about one-third of a billion dollars annually by the use of radioisotopes to cut costs over the older, more conventional methods. He predicted that this value of savings will continue to grow—in 1953, the savings were estimated at only $100 million.

For one thing, Chairman Strauss pointed out, ". . . the known applications of radioisotope techniques have by no means saturated the market. It is estimated, for instance, that the market for radioisotope thickness gages is less than ten percent saturated."

The Chairman's thoughts were based on a survey made late last year by the AEC among some 140 industrial users of radioisotopes. The purpose of the survey was to get industry's own appraisal of the value of radioisotopes to the national economy in the light of present uses. The over-all estimates ranged from $295 million annually on the "low" side to $485 million on the "high" side—an average of $391 million a year. A more recent survey, made this summer, raised this estimated average to $406 million in annual savings. (See Table No. 1)

Table No. 1

	Annual Savings in Millions of Dollars Probable Low	Probable High
Cigarette Density Gages	42.7	57.0
Metal Thickness Gages	18.5	27.8
Plastic and Adhesive Thickness Gages	2.0	6.1
Paper and Allied Products Thickness Gages	23.1	24.9
Other Thickness Gages	2.3	6.9
Gages such as Liquid Level, Moisture, Hydrogen-Carbon Ratio, Snow, etc.	2.5	7.6
Radiographic Testing	28.7	64.6
Oil Well Logging	16.0	24.0
Oil Well Stimulation	120.0	180.0
Pipeline Oil Flow	0.5	0.7
Petroleum Refining	5.3	10.1
Other Appiled Industrial Tracing	12.5	25.0
Tool Wear Studies	0.8	1.2
Piston Ring and Similar Wear Studies	12.0	18.0
Corrosion Studies	3.0	4.6
Other Industrial Research	12.0	18.0
Luminescent Sources	1.7	2.7
Miscellaneous Industrial Applications	0.5	0.8
Totals	312.1	500.3
Average	406.2	

The radioisotope has no direct bearing on the individual farmer or rancher. His savings—an estimated $200 million annually for the whole agricultural industry—come from the applications of the results of agronomy research conducted with isotopes.

To the average person, radioactivity can best be described in the words of the English scientist Smithells, who said, in 1908, that radio-chemistry is the "chemistry of phantoms."

Radioactivity is not new, it is just that only in recent years man has learned some of its basic principles and how to utilize them. Mankind has always been subjected to radiation caused by the sun's cosmic rays and the radio elements in the natural environment (atmosphere, stone, soil, and water). Radium, one of the few naturally radioactive elements, was discovered in 1898; but it was not until 1932 that the first radioisotope was synthesized by bombarding stable atoms with neutrons to create artifical radioactivity. However, since the cyclotrons and "atom smashers" of the 1930's could produce only very small quantities of radioisotopes, they remained little more than scientific curiosities.

The first industrial use of radioisotopes, on an experimental scale, was achieved shortly before World War II. Small amounts of cyclotron-produced phosphorus-32, added to the metal mix, was used to study the wear of piston rings. Today, for such studies, conventional piston rings are made radioactive by subjecting them to neutron bombardment in nuclear reactors.

The advent of nuclear reactors in conjunction with wartime development of the atomic bomb made it possible to create great quantities of radioisotopes at reasonable cost as a byproduct of reactor operations. The reactors create radioisotopes in two ways: as a "waste"* byproduct, or by irradiation of normally stable elements so that they become radioactively "hot."

In any nuclear reactor operation, a certain amount of residual ash forms which is highly radioactive. These ashes can be treated by chemical and thermal methods to separate the radioisotopes and so make them available for industrial, medical, and agricultural research uses.

In the second method of radioisotope production, materials composed of stable atoms are placed in the core of a reactor and subjected to neutron bombardment. This upsets the normal arrangement of nuclei in the atoms, and they become "hot"; giving off radioactivity (energy particles or rays) as they seek to return to a stable state.

The Commission sells radioisotopes practically "at cost" to industrial users, and ordinarily gives an 80% discount where the material will be used for medical research.

The AEC's principal distribution center for radioisotopes is the Oak Ridge National Laboratory in Tennessee. A few specialized shipments are made from other Commission facilities such as Argonne National Laboratory, Lemont, Illinois; Brookhaven National Laboratory, Upton, New York; Mound Laboratory, Miamisburg, Ohio; and the National Reactor Testing Station,

*The term "waste" is actually a misnomer, since the material can be processed and useful radioisotopes obtained from it. However, the term "waste" byproduct has come into common acceptance in the nuclear industry to mean the ash or residue formed in nuclear operations before the radioisotope byproduct has been processed out of it.

(Continued on Page 26)

CHAPTERS IN CHEMICAL WARFARE

I

ADMIRAL COCHRANE'S PLANS FOR CHEMICAL WARFARE

By Wyndham D. Miles*

U. S. Army Chemical Corps Historical Office

Although phosgene, cyanogen chloride, and other war gases are fairly modern discoveries, there is one unbreatheable gas that has been known since ancient times. This is sulfur dioxide, the gas that arises from burning sulfur. The Egyptians, Greeks, Hebrews and Romans used burning sulfur to fumigate buildings. The alchemists of the middle ages were certainly acquainted with the gas since they employed sulfur in many of their operations. In view of the wide-spread knowledge of sulfur dioxide, one may wonder why armies did not use burning sulfur in siege operations or maneuvers. But so far as the author is aware, sulfur dioxide was not suggested as an agent of warfare until the 19th Century.

In 1811 a young British Naval officer named Thomas Cochrane, later Admiral Cochrane, Lord Dundonald, visited Sicily, the world's chief supplier of sulfur, and observed the method of production. On Sicily sulfur was mined and then purified by sublimation. Sicily had no coal, so the miners burned sulfur to furnish the heat for the sublimation process. Sulfur dioxide fumes from the kilns killed vegetation for miles around and drove away anyone standing to the leeward. This gave Cochrane the idea that burning sulfur could be used to drive soldiers away from tortified positions.

In March 1812 Cochrane sent to the Prince Regent a plan for driving Napoleon's forces from fortifications in Toulon, Flushing and other ports by means of sulfur dioxide. He suggested that the Admirality load several ships with alternate layers of sulfur and coal, and then have an attacking fleet anchor the vessels to the windward of the forts and set the sulfur afire. The government appointed a committee to examine the scheme. The committee stated cautiously that the plans were so novel that they could not give a firm opinion, but that they were at bit doubtful of the success of such an attack because of the variable, uncontrollable factors of wind, weather, currents and tides. If the government had approved Cochrane's plan and put it into general use, not only Napoleon's troops on the Continent, but American soldiers fighting in the War of 1812 might have been gassed by sulfur dioxide.

Cochrane was not discouraged by the government's refusal of his plan. In 1846 he submitted it once more, but now with a new feature, the addition of a smoke screen to shield the operation of the sulfur ships. Again

ADMIRAL THOMAS COCHRANE

(From the Book "Life of the Earl of Dundonald")

the government appointed a committe to judge the merits of the idea and again the committee voted against it. They felt that the use of sulfur dioxide would be against the rules of warfare, and they also pointed out that the British would not be able to retain the idea once it had been used in combat.

In 1854 the Crimean War gave Cochrane another opportunity to offer his idea. He drew up a plan of operations for taking Cronstadt, using smoke ships to protect the sulfur vessels. The Ordnance Office set up a committee to study the plan, and the committee reported against it, calling it a rash enterprise and doubting that smoke vessels would provide satisfactory cover. Michael Faraday, the great English scientist who sat on the committee, also thought that it would not be difficult for the attacked force to provide respirators to protect their men—an early suggestion for a gas mask. The old Admiral was still not discouraged, and he returned a year later with plans for driving the Russians from Sevastopol. The government once more considered the idea, but before

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anything could be done the fortress had fallen, and with it went Cochrane's last chance of introducing chemical warfare.

Cochrane died in 1860, bequeathing his chemical warfare plans to the chemist Lyon Playfair. Playfair later returned the documents to the family. In 1908 a copy of Cochrane's plan for the attack on Sevastopol was published in *The Panmure Papers* (Lord Panmure had been Secretary of State for War in 1855), but no one seems to have noticed it at the time in this out-of-the-way book.

Then came World War I, and Cochrane's grandson, Lieutenant General Lord Dundonald, presented the idea to Lord Kitchener. Kitchener would not consider it for the army, but he told Dundonald to try the navy. Dundonald visited the Admirality and found that Winston Churchill was interested. In correspondence that followed Dundonald pointed out to Churchill that the prevailing winds in Flanders favored the British, and he suggested that any operations be carried out by men protected by gas-proof helmets and screened by smoke. Churchill would not adopt the sulfur dioxide plan, but he saw the value of smoke screens. He formed a technical committee, headed by Dundonald, to develop smoke mixtures and munitions and to test them on land and sea. The favorable results of this work caused the British to develop smoke screens for the army and navy.

On April 22, 1915, the German Army launched the first gas attack, using chlorine. This was almost a century after Cochrane first proposed a gas attack.

What can we say of Cochrane as the inventor of modern chemical warfare? He can hardly be so credited as his plans were hidden away for a hundred years, and the German chemist, Fritz Haber, independently of any suggestion from Cochrane, proposed and supervised the first gas attack. But even though Cochrane can not be credited with inventing gas warfare, he still deserves recognition for providing the impetus that led the British to develop smoke screens.

Bibliographical Note

Several books have been written on Cochrane, among them: *Lord Cochrane, Seaman-Radical-Liberator* (New York, 1947), by Christopher Lloyd; *Life of the Earl of Dundonald,* by Joseph Allen, (London 1861); *The World Crisis* (London 1923), by Winston S. Churchill, which deals in part with Cochrane's ideas on military use of smoke; *The Panmure Papers* (London 1908), George Douglas and George Dalhousie Ramsay (editors); and also, *Chemical Warfare* (New York, 1921), by Amos A. Fries and Clarence J. West, which contains excerpts from *The Panmure Papers.*

II

THE CHEMICAL SHELLS OF LYON PLAYFAIR (1854)

THE RT. HON. SIR LYON PLAYFAIR
(From Wemyss Reid's Book of Playfair's Memoirs)

Gas was first used in warfare by the German army at Ypres in 1915, but if the British government had accepted the ideas of the chemist, Lyon Playfair, the British Army and Navy would have used toxic chemicals sixty-one years earlier in the Crimea.

In 1854 Playfair grew concerned over the Crimean War and suggested two new munitions to the Ordnance Department. One was a hollow, brittle shell filled with a solution of phosphorus in carbon disulfide. In theory the shell would break against the target and spatter phosphorus solution over the area, setting any combustible material on fire. The other munition was a brittle shell filled with cacodyl cyanide. Playfair intended this for use against Russian naval vessels. "Such a shell," he wrote, "going between decks of a ship would render the atmosphere irrespirable, and poison the men if they remained at the guns."

The War Department refused to accept Playfair's ideas on the grounds that such a mode of warfare would be as bad as poisoning the enemy's water supply. Playfair pointed out the illogicalness of the War Department's argument: "There was no sense in this objection. It is considered a legitimate mode of warfare to fill shells with molten metal which scatters among the enemy, and produces the most frightful modes of death. Why a poisonous vapor which would kill men without suffering is to be considered illegitimate warfare is incomprehensible."

Finally Playfair made a prophecy concerning chemicals in war: "No doubt in time chemistry will be used to lessen the suffering of combatants." Some seventy

(Continued on Page 40)

YOUR TAX DOLLAR

and the

PART OF THE U. S. ARMY CHEMICAL CORPS IN THE DEPARTMENT OF DEFENSE STANDARDIZATION PROGRAM

by

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Cataloging and Standardization Division

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Directorate for Engineering Documents

U. S. Army Chemical Corps Engineering Command
Army Chemical Center, Maryland

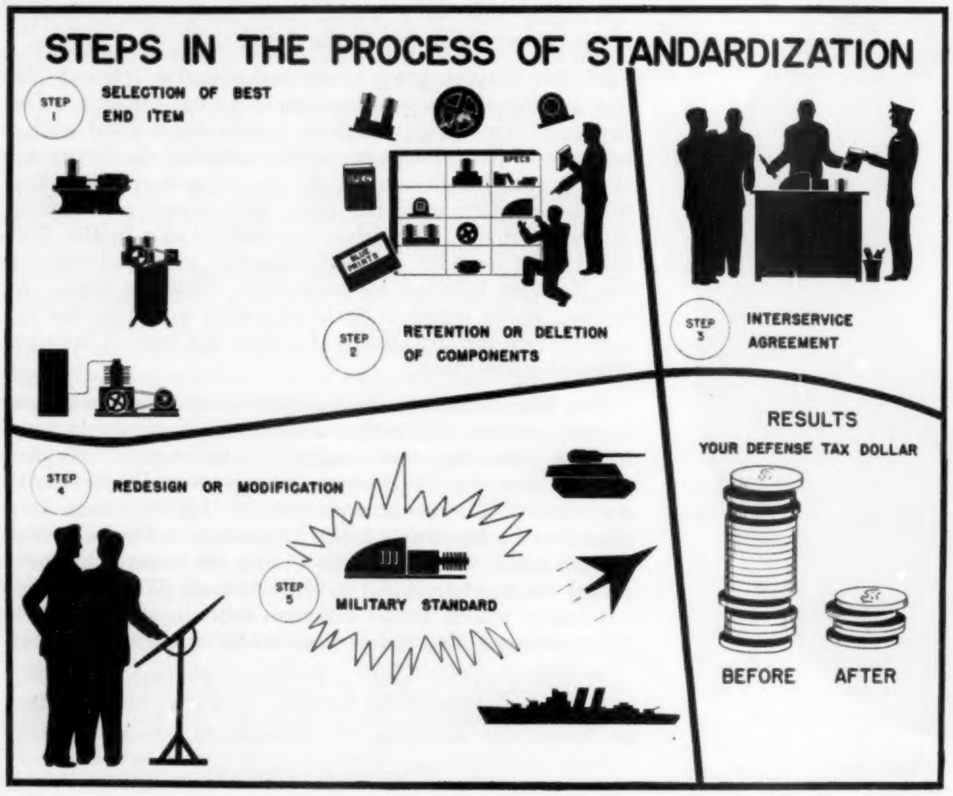
FEW PEOPLE UNDERSTAND the nature of the Department of Defense Standardization Program or realize its importance. The program involves complex and tedious operations; but the time and money expended on its completion will be amply justified, not only by the cash savings realized, but also by simplification of supply operations and by the strengthening of national defense that results.

In the past, there has been considerable duplication and near duplication of items of supply carried in the systems of the various services. The effect of duplication has been to clutter the supply systems with a multitude of unnecessary items; and the fact that all services have stocked items serving the same general purpose as similar, but not identical items, in other services has prevented interchange of these items between the services.

The disadvantages of our past method of operation are at once apparent: relatively ineffective combat potential, high cost of inventories, and inefficient supply practices. By simplifying the supply structure and providing for maximum interchangeability of the supply items of one service with those of another, the nation's combat effectiveness will be increased; economies may be realized through lower inventories, with no decrease in safety; and supply to all services will be considerably more efficient.

The remainder of this article explains the full concept of the standardization program and details the methods by which it is accomplished.

The Department of Defense Standardization Program was established by Department of Defense Directive 4120.3, dated 15 October 1954, which was promulgated by authority of the Department of Defense Cataloging and Standardization Act (Public Law 436, 82nd Congress). It calls for reduction in the number of items in the supply system and the standardization of materiel throughout the Army, Navy, and Air Force.



THE PURPOSES of the Defense Standardization Program are to improve the efficiency and effectiveness of logistical support and operational readiness of the Army, Navy, and Air Force and to conserve time, money, manpower, production facilities, and material resources in the process. The goals are to be achieved by:

1. Adoption of the minimum number of sizes, kinds, or types of items and services essential to military operations.

2. Achievement of the higher degree of interchangeability of the component parts used in these items.

3. Development of standard terminology, codes, and drawing practices to achieve clear understanding by all services and to insure that descriptions of items and practices will be uniformly interpreted.

4. Preparation of engineering and purchasing documents to insure the design, purchase, and delivery of items consistent with the scope and purpose of the Defense Standardizaion Program.

5. Providing the military departments with the most reliable equipment possible by the adoption of materiel which has been evaluated in accordance with established government specifications and standards.

The various services have made sporadic attempts to standardize equipment in the past, but until the implementation of the present program, such attempts by individual services have fallen short of their goals. Now, however, with high emphasis on the integrated program, and with careful organization behind it, substantial progress has already been made toward realization of the ultimate goal.

AT THIS TIME, the Chemical Corps has substantially completed the cataloging phase of its work under the Cataloging and Standardization Act, and has reduced the number of items in its supply system by approximately 20 per cent. A few typical examples of this reduction are:

a. The elimination of eleven (11) items from the Chemical Corps supply system; i.e., denatured alcohol which has included various formulas listed in the Treasury Department's formulas for "Completely and Specifically Denatured Alcohol," as well as varying package sizes from four-ounce bottles to 55-gallon drums. After proper research and coordination in the Department of the Army with other services to satisfy their needs, one formula for denatured alcohol was made standard and intermediate package sizes were eliminated. A net savings of $50,000 per annum in this one small area of chemicals alone was accomplished.

b. Under the Department of the Army packaging and repackaging program, well over $500,000 was saved during Fiscal Year 57. This program is still in progress and many thousands of dollars more will be saved.

c. A third example was accomplished through redesign of many items in the chemical munition field. Redesign often involves only a comparatively simple change, as in the 750-pound fire bomb. In this case, change from a welded assembly to a bolted and riveted assembly reduced the cost of items under procurement in Fiscal Year 1957 by $120,000.

These are typical examples accomplished under the old phase of standardization by the Chemical Corps. The Department of Defense's Standardization Program (the new phase) which will be accomplished by Federal Supply Classification Structure (groups of homogeneous items), set forth under the Federal Cataloging Program will no doubt bring great savings also. The second phase of the program, simplification or reduction by selection, will effect a further reduction in inventory. The third, or technical analysis phase, will further reduce the number of items by redesign of the items to effect complete interchangeability of units and components parts. The latter two phases are now in process.

The ultimate achievement of standardization will be the establishment of standards which set forth the technical applications and limitations of items, materials, processes, and designs. This goal will be achieved by a reduction in the number of approved items, materials, processes, and designs, resulting in the functional and physical interchangeability of parts, components, and equipments and in the compatibility of items and equipments in all supply systems. This desirable accomplishment will be facilitated by the establishment of basic engineering terminology and by a reduction in the variety of end-use items available.

UNDER THE Department of Defense system of standardization some 510 classes of materiel have been established. Each class has been assigned to the service having highest qualification for responsibility for that class. The technical service (Army), bureau (Navy), or command (Air Force) responsible for a class is known as the assignee activity. As classes are assigned to an activity, standardization proceeds in a series of steps depicted in the accompanying drawing and described below.

1. The assignee activity assembles all information available in the Department of Defense pertinent to the assigned class. The activity then selects the end items which best satisfied the needs of all services and which has he greatest standardization potential.

2. A technical analysis is made of the history of end items and test data on them. On the basis of this analysis, various items are determined to be unnecessary and are obsoleted. This analysis embraces such factors as military characteristics and possible secondary uses of the items, new concepts under development as replacement items, and numerous other aspects such as storage characteristics, comparison of the military item with standard commercial items, potential interchangeability of parts of the various items, critical materials required, and the like.

3. By processes similar to those enumerated in step 2, determination is made of the best standard parts in the supply system. The several services cooperate in this determination, selecting those components which most completely meet their required military characteristics.

4. The best engineering skill is now called upon to combine the components selected in step 3 into an end-item design which will satisfy all user needs. In the event that no one end item can be designed to satisfy all requirements, more than one end item will be developed but every effort will be made to employ the same components in all items.

5. Final engineering testing constitutes the final step in standardization. With such tests satisfactorily passed, an item is standardized and is available for requirements of all services.

If standardization is considered merely as a process of reducing the number of items in a supply system, it may appear to the uninitiated to be a very simple procedure. It is hoped that this brief resume has shown that the procedure is far from simple but that results already obtained under the program, as well as those now envisioned, are making possible great monetary savings to all taxpayers.

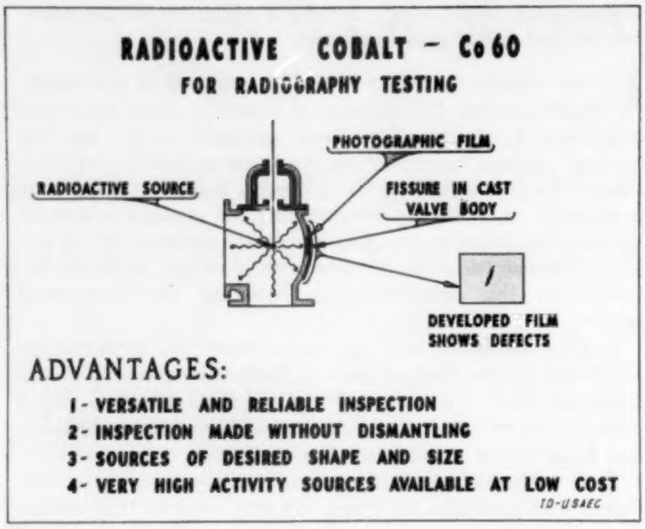


Figure 9

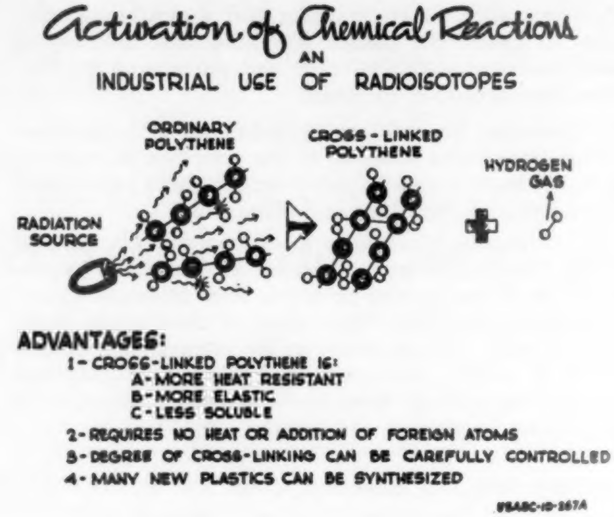


Figure 10

RADIOISOTOPES

(Continued from Page 21)

Idaho Falls, Idaho. The Commission's facilities are the nation's prime source, at present, for radioisotopes.

Oak Ridge made its first shipment of radioisotopes on August 2, 1946—a small amount of carbon-14 for cancer research—under the government's program of making these bits of radioactivity available in quantity and variety to industry and medicine. On August 26 of this year, Oak Ridge made its 100,000th shipment.

INDUSTRIAL usage of radioisotopes during the first four years of the program was slow to take hold, and by 1950 there were only 100 users. As word of the economies being effected spread, so did the program, and by 1953 there were 800 manufacturing and processing organizations utilizing radioisotopes. By 1956, there were 1,266, and today, the figure is well above the 1,700 mark.

Such figures, however, do not show the true growth of the industrial isotope program. For one thing, while the majority of the Oak Ridge shipments are in individual lots to individual users, many are also bulk lots of byproduct radioisotopes which are carried on the Commission ledgers as single shipments. This bulk material is bought by about 100 firms—there were only 17 in 1951—which process the radioisotopes into forms suitable for a variety of uses and make thousands of shipments of their own. Secondly, there are many users of small quantities of isotopes who receive their material under a general license and which are not included under the above user-figures.

From the start, medical science has held a slight lead over industry in the number of licenses issued by the Commission to possess and use byproduct radioisotopes. Together, they account for about 80% of the licenses issued through June, 1957. Currently, about 42% of the licenses are held by hospitals and private practicing physicians, industrial organizations hold nearly 40%, colleges and universities 7%, federal and state laboratories nearly 2%, foundations and institutions 8%, and other specialized users 1%. Here again, a large number of users are not accounted for since they purchase radioisotopes under general licenses which are not counted.

The Atomic Energy Act of 1954 made the Atomic Energy Commission responsible for regulating the possession and use of byproduct and special nuclear materials through a licensing system. (AEC licenses are not required for radioisotopes found in nature, such as uranium and radium, nor those produced by cyclotrons.)

The Commission issues two types of linceses in connection with radioisotopes, general and specific. The full requirements for the two types of licenses are published in the Federal Register, under Title 10, Code of Federal Regulations, Part 30. Ordinarily, general licenses are published in the Federal Register for small amounts, and specific licenses are issued by the AEC for large amounts.*

Licenses issued may be broad or narrow in scope. For instance, a physician may be licensed only for radioiodine use in humans for thyroid therapy; or an industrial firm may have a license to use many types and quantities of isotopes for research, development, and processing applications.

So far, scientists have identified nearly 1,200 isotopes of the 102 known elements. About 275 are naturally stable isotopes giving off no radioactivity and about 50 are naturally radioactive. Some 900 or more can be made radioactive synthetically.

While stable isotopes have many scientific uses, they are not as versatile as the radioisotopes and require costly equipment and considerable time and effort to provide the information sought from their use. However, the abundance, versatility, and ease of use has made the radioisotope a tool which many industrial firms would be hard-pressed to get along without if it were suddenly taken away. (For purposes of this article, any reference to the word "isotope" should be construed to mean only the man-made radioisotope.) (Figure 8)

Industry today is using 100 different radioisotopes representing 68 various chemical elements in a wide variety of jobs. Industrial applications, however, are not limited to just these 100 varities, it is only that they are the most easily obtainable from the current major source—the Commission's experimental reactors.

To keep pace with the growing demand for more and more radioisotopes, the AEC is completing a new multi-curie fission products plant at Oak Ridge. The plant will have a capability of separating 200,000 curies of cesium-137 annually from reactor "waste." Other isotopes such as strontium-90, cerium-144, and technetium-99 can also be recovered at the same time. With the addition of the new plant, Commission officials expect

*Full information on licenses and how to obtain them will be furnished, upon request, by the Division of Civilian Application, U. S. Atomic Energy Commission, Washington 25, D. C.

the price of cesium-137 to drop to between $1 and $5 per curie. Currently, the price is $14 per curie, and just a few years ago it was $100 per curie.

(A curie can be defined as the radioactivity produced by one gram of radium in one second—10,000 curies of cobalt-60 are roughly equal to 13,500 grams of radium in terms of radioactivity; or, any quantity of material which has 37 billion atomic disintegrations per second is rated at one curie of radiation.)

THE RAPID growth of industrial uses and users may soon exceed the supply of radioisotopes—especially cobalt-60. As a result, the Commission is fostering the idea of private enterprise producing radioisotopes for industrial use. The new plant at Oak Ridge was built with an eye toward helping to meet the demand for isotopes during the initial stages of industry's development of its own production facilities, and, at the same time, it will also serve as a pilot plant for future privately-owned fission product separation plants processing the "waste" byproduct from industrial reactors.

In February of this year, AEC officials told a Congressional committee, "For the first time since the initiation of the radioisotope distribution program in 1946, the economic feasibility of private enterprise participation in radioisotope production appears imminent. Actual undertakings by private industry in this area primarily are dependent upon sufficient further development of the radioisotope market to support private radioisotope production reactors."

Early this summer, a Buffalo, N. Y., firm—already in the nuclear instruments manufacturing field—announced plans to build the nation's first nuclear reactor specifically designed for commercial isotope production. It will create a million curies of cobalt-60 a year, and the byproduct steam will be sold to a paper and pulp mill. Present facilities of the AEC produce only about 400,000 curies of cobalt-60 a year.

In a recent Chicago speech, E. Eugene Fowler, Deputy Assistant Director for Isotopes and Radiation of the AEC's Division of Civilian Application, said that about 50% of the nation's 500 major manufacturing companies, are now using radioisotopes in some manner.

A check of the Armed Forces Chemical Association's group and sustaining members shows that more than 49% of them have used radioisotopes.*

Possibly one of the most succinct summations of what radioisotopes mean to industry was made recently when a rubber manufacturer reported: ". . . 11% more tire fabric produced exactly on specification; 12.7% more fabric within limits of plus or minus .01 pounds per square yard; 40% reduction in total deviation from the average weight; marked increase in improvement of sheet profile brought about by increasing uniformity of feed banks directly attributable to accurate control of rollers; $65,520 estimated annual savings from 1.8% reduction of the upper tolerance limit; tremendous annual savings in raw rubber stock and more uniform fabric."

Installation of radioisotope devices in industry have been found, on an average, to pay off the initial investment in less than a year—generally within a few months.

Radiographic testing in the metals fabrication trade is a good example. This method of quality assurance calls for either an x-ray or radioactive source to be placed on one side of the casting or weld, and a photographic film on the other. The strong gamma rays penetrating the material leave an impression on the film which shows up any flaws. Until a few years ago, only the larger foundries could afford such equipment—x-ray machines are expensive, and naturally-radioactive radium was the only other radiation source available. (Figure 9)

Today, radioisotopes such as cobalt-60, ceisum-137, and iridium-192 have largely replaced radium as a source material because of the relative cheapness of the isotopes. For instance, the purchase price of a 500-millicurie source of cobalt-60 will run about $50. Additional charges of some $35 for enclosing it in a capsule, $10 for handling and shipment, and between $400 and $500 for the necessary safety monitoring instruments and containers raise the figure up to about $600.

Using radium as a source material would put the cost much greater, since $100 worth of cobalt-60 can do the same job it would take $20,000 worth of radium to do. In addition, cobalt-60 has a penetrating power approximately 50% greater than the same quantity of radium. Also important is the fact that a radioisotope radiographic machine is less bulky and more transportable than either an x-ray or radium-source device and can be used for inspecting welds or during the construction of a chemical plant complex.

MANY OF the unborn uses of the radioactive atom are chemical in nature and await only the ingenuity of the chemical scientist or engineer to be brought to light. For instance, the organic chemical industries, including the petroleum business, as yet have not made any major important use of either radioactive carbon or radioactive hydrogen, two of the most important organic elements in normal manufacturing operations. Undoubtedly, there are applications of extreme importance to every organic chemical industry in the manner of controlling production operations by judicious labeling of the material be-

(Continued on Page 33)

*A complete listing of the industrial users, and their uses of radioisotopes, during the first ten years of the Commission's industrial isotope program was published in August, 1946, by the Atomic Industrial Forum, Inc. (non-profit organization), 3 East 54th Street, New York City 22, price $2.50, under the title "Industrial Utilization of Radioisotopes, 1946-1956." The list includes AFCA industrial users.

NEW AEC INSTALLATION

The Engineering Test Reactor at Idaho Falls, Idaho

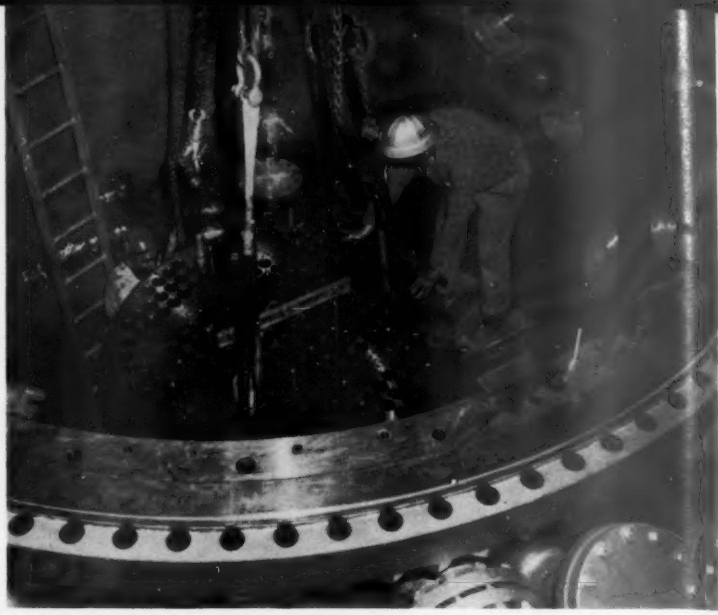
Facility, Dedicated October 2, is Important Development in Commission's Program for Nuclear Power.

The Engineering Test Reactor, most powerful known source of radiation for use in developing nuclear power plants of the future, recently completed at the National Reactor Testing Station of the Atomic Energy Commission, near Idaho Falls, Idaho, was dedicated in an elaborate two-day program there, October 2 and 3.

This newest member of the family of reactors at the Testing Station was constructed at a cost of approximately $17.2 million. It was pioneered by the adjacent, less powerful, Materials Testing Reactor, which has been in operation for the past five years. The MTR will continue to be used in research and small sample testing.

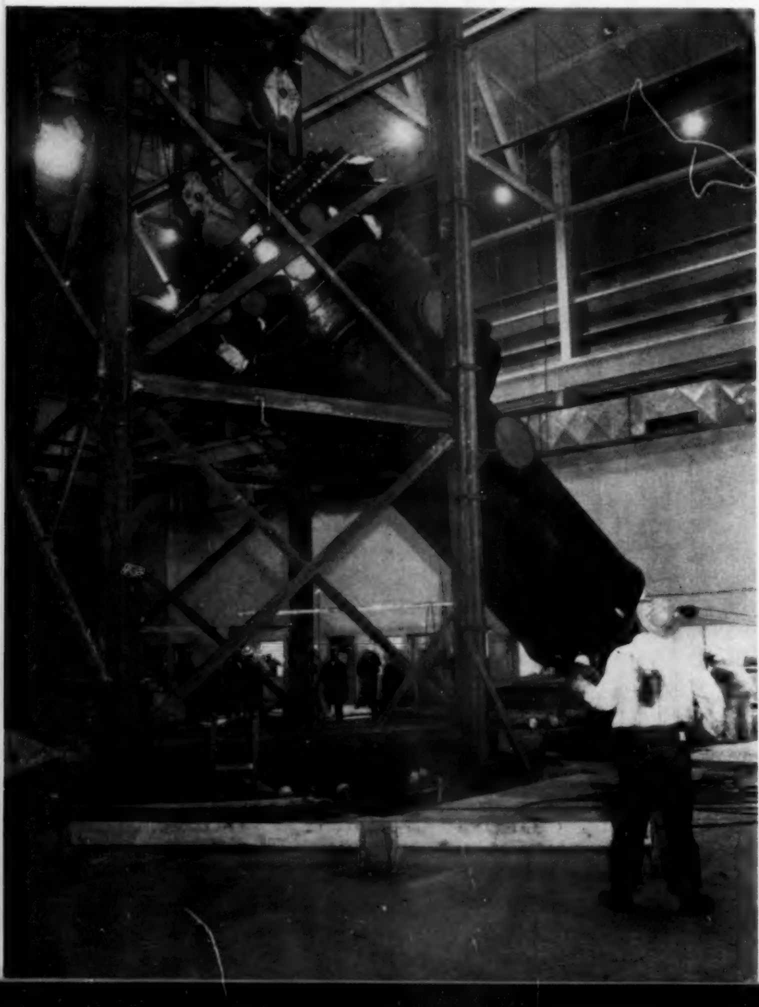
The ETR brings into operation the highest neutron flux, or rate of flow, created by the fissioning of enriched uranium placed within its core. This, it is stated, will average 1.9-million billion neutrons per square centimeter per second, or approximately double that of any other known reactor available for the testing of materials.

The ETR will be used principally to determine the effects of intense neutron and gamma ray bombardment, or "radiation damage" on engineered components and materials under conditions to be met in nuclear power plants of the future. It thus is a major development in the Commission's program to advance the design and construction of nuclear reactors for civilian and industrial use and to convert aircraft and ships to nuclear propulsion.



Workmen lowering Engineering Test Reactor grid plate into 35 foot deep pressure vessel at the National Reactor Testing Station, Idaho. Situated in an inner tank 27 feet below the vessel's top head, the grid plate supports the reactor core assemblies and reflector pieces. The large square and rectangular holes in the grid plate, 17 in all, are spaces for the insertion of fuel elements, fuel assemblies, reactor components, and other test materials in the reactor's very high thermal and fast neutron fluxes. The openings in the grid plate also provide for the testing of various coolants. (Official Photo, Atomic Energy Commission, Idaho Operations Office, Idaho Falls, Idaho)

The reactor vessel, "heart" of Engineering Test Reactor, is raised to near vertical position for lowering into external thermoshield receptacle. The vessel is 35 feet high with an upper diameter of 12 feet and a lower diameter of 8 feet. It weighs 75 tons. (Official Photo, U.S. Atomic Energy Commission, Idaho Operations Office, Idaho Falls, Idaho).



Approximately 300 members of U. S. industry, members of Congress, federal and state officials, and members of the press attended the dedication program, which included an industrial preview symposium followed by a visit to the plant located in an isolated area some 50 miles west of Idaho Falls.

The principal speakers on the program were Commissioner Harold S. Vance, member of the United States Atomic Energy Commission, who spoke on the Commission's "basic philosophy," and Senator Henry M. Jackson of the State of Washington, member of the Senate Armed Services Committee and the Joint Committee on Atomic Energy, who stressed the importance of government-industry cooperation in atomic development. On the subject of developing atomic power for civilian and industrial use, Commissioner Vance's speech favors concentrating United States' efforts on "research and orderly development," refraining from "extreme exploitation" pending achievement of more economical processes. Senator Jackson's address, on the other hand, views the matter as an international race, considers an all-out program urgent and declares "If some other nation . . . gets there first with the best and the most in atomic power, the international prestige of our country will suffer a severe blow." Condensations of both of these addresses are presented in this issue of the JOURNAL.

The preview symposium brought forth a number of highly informative and interesting papers of semi-technical nature. These included a presentation by Mr. W. Kenneth Davis, director of reactor development of the Atomic Energy Commission, and papers also by representatives of the Henry J. Kaiser Company, which designed and constructed the overall facility; The Phillips Petroleum Company, which prepared the conceptual

(Continued on Page 30)

ATOMIC ENERGY COMMISSION BASIC PHILOSOPHY

The following is excerpted from the address presented at Idaho Falls, Idaho, on October 2, 1957, during the Engineering Test Reactor Dedication Program by

HAROLD S. VANCE

Commissioner of the United States Atomic Energy Commission

—Photo by Jean Raeburn, N.Y.

Mr. Harold S. Vance was sworn in as a member of the U.S. Atomic Energy Commission on October 31, 1955. He was previously Chairman of the Executive Committee of Studebaker - Packard Corporation, South Bend, Indiana, and had been with the Studebaker Company from 1911 to 1917 and from 1919 to 1955.

From 1918 to 1919 Mr. Vance was production engineer for the Bethlehem Steel Company. He became a special consultant to the Director of the Office of Defense Mobilization in 1953.

Mr. Vance was born in Port Huron, Michigan, on August 22, 1890.

I AM TAKING advantage of this opportunity to speak on a matter which gives me some concern. That is a misconception or lack of understanding by far too many people of the basic philosophy of the Atomic Energy Commission in its endeavor to promote the peaceful uses of atomic energy.

An example of how far afield this misconception of Commission plans and purposes can go is found in a recent speech of a well-known educator who said in effect that the time has come when the Atomic Energy Commission should be liquidated because of its sinister purposes. Among these sinister purposes he listed the creation of a monopoly in the field of high energy physics, including all of their potential applications; the federal control of education; and, finally, even the nationalization or socialization of industry. If there were the slightest foundation for such assertions, they would be serious indeed.

. . . it is appropriate that I should give you a clear statement of the basic philosophy of the Commission in discharging its statutory responsibilities, particularly as it affects industry and education.

As a first step in this process, I should remind you that the Atomic Energy Commission has two major purposes or reasons for its existence. The first of these was the original purpose of the wartime Manhattan District; it is to design, develop, and manufacture nuclear weapons. That still is the primary and overriding responsibility of the Commission, one upon which I firmly believe the peace and safety of the world depend. The other major objective of the Commission is to promote the development of nuclear energy for peaceful purposes. The importance of this second objective is great as we all recognize. It is second only to the maintenance of that military strength which guarantees our existence as a nation. . . .

One of the areas in which the Commission has been often misunderstood stems from the interrelation of the two distinct purposes of the Commission which I have just stated. It is the matter of secrecy. There is no clear demarcation between the military and the civilian technical work of the Commission. I think you will agree with me that in matters having to do with military application it is extremely important that the Commission take every possible precaution against the weakening of our national security by allowing important military information to fall into the hands of those who are or could be potential enemies of ours.

There is evidence that the whole body of technical knowledge about nuclear weapons possessed by the Soviet Union did not generate inside its own scientific competence. On the contrary, it is clear that an important segment of that knowledge was obtained from us, some of it through inadvertence and some of it, as we all know, through the disloyalty of individuals privy to some details of our know-how. The danger to our national security through lack of proper security measures is as great or greater today than it has been at any time in the past, and the responsibility of the Commission to safeguard this security is not relaxed nor is it likely to be in the foreseeable future.

I said that there was no clear line of demarcation between military and civilian technology in the atomic energy field. This being true, the Commission must be doubly sure that in releasing what appears to be strictly civilian information it is not at the same time compromising information of military value. This fact accounts for the frequent criticism of the so-called "secrecy policy" of the Commission, which criticism is, I believe, quite without justification. . . .

The philosophy of the Commission in its endeavor to promote the peaceful uses of atomic energy is to make it a normal American business with maximum industrial participation and minimum governmental participation as soon as possible. . . .

There are two important services which must be available if nuclear power plants are to be built and operated either at home or abroad. The first of these services is fabrication of fuel elements; the second is reprocessing them so that the unburnt fissionable material may be recovered. Already several American firms have entered the field of fuel element fabrication, and we look toward the time when increased volume and decreased costs due to technological advances will make the chemical reprocessing business attractive to

industry. The Commission is eager to retire from this field just so soon as industry is ready to offer this necessary service at prices which are reasonable and will not discourage the advancement of nuclear power.

The Commission is anxious to have industry take up the making of radioactive isotopes and will retire from this field as soon as it can properly do so. . . .

Reference to the International Agency leads me to another misconception of Commission plans which is that we are allowing other countries to outstrip us in the atomic power race and that we are losing our position of pre-eminence in this field because we are not planning to build in the next few years as many kilowatts of nuclear power capacity as are programmed by Britain, Russia, and the countries of Western Europe.

This matter of where we stand relative to other countries in the development of nuclear power cannot be properly judged without a full realization of the great difference between power economics at home and abroad.

We in the United States are blessed with large resources of fossil fuels to say nothing of a considerable amount of yet undeveloped hydroelectric potential. We have cheap electric power and will continue to have it in adequate supply from conventional fuel sources for at least another generation. . . .

Britain, once a great exporter of coal, had to import last year nearly one-fifth, 19% to be exact, of the fuel needed to produce electricity. It is estimated that by 1975 Britain will have to import over 50% of its fuel needs except for such relief as may come meanwhile from the exploitation of nuclear power.

A similar situation to that of Britain exists in the Euratom countries of Western Europe, in Sweden, and in Japan. . . .

Contrast the economic pressures in countries where electric power costs twelve mills per kilowatt hour with the lack of such pressure in our own country where the average cost of new power is about six mills, and it becomes quite apparent that the exploitation of nuclear power will and should proceed at a much faster pace abroad than it can justifiably do at home. We should congratulate ourselves that we have time in which to make further progress toward much more economical nuclear power before we have to use it extensively. Paradoxically, there is a realization abroad although not at home of how fortunate is our situation in the United States. In the eyes of our foreign friends, we are just exercising plain common sense in concentrating our efforts on research and orderly development, refraining from extreme exploitation until we can do so without doing real violence to sound economics.

The Commission is very much in favor of our helping our foreign friends in carrying out their ambitious programs for nuclear power. In exchange of information about operation as well as design improvement we shall receive valuable aid toward our goal of nuclear power so economical that we can use it profitably in our own country.

It seems to me that the examples which I have given you are clear proof that the aim of the Commission is not to promote nationalization or socialization of American industry, but, in fact, is exactly the reverse thereof.

With respect to the accusation that the Commission is trying to control education or influence it improperly it has been said that the Commission is attempting to limit its support of basic research in some manner and to concentrate it in government owned national laboratories. While of necessity research work in the field of military application must be confined largely to our own laboratories, research in the fundamentals of nuclear science and in its peaceful uses is done to a great extent for the Commission not in its own laboratories, but on the campuses of universities and in the laboratories of private industry. At this time we have over seven hundred research contracts with universities. . . .

That many ambitious young scientists should choose to work on Commission projects is but natural. Atomic energy is a new and exciting field with infinite possibilities. . . .

In increasing numbers, universities and colleges are setting up as a part of their regular curriculum, courses in nuclear science. To help them do so, the Commission is making grants for necessary equipment and is offering fellowships to induce students to elect these courses. It it is the policy of the Commission to foster an independent spirit in the universities which are preparing to teach nuclear science. We are interested in encouraging them, but not in controlling or influencing them in any improper way.

I would think that within a decade, but surely within a score of years, we shall see an evolution accomplished wherein industry has completely taken over and has assumed its normal position in the field of peaceful uses of atomic energy; wherein our institutions of higher education have developed nuclear science as a regular part of their courses in general science. . . .

NEW AEC INSTALLATION

(Continued from Page 28)

design and will operate the ETR for the Atomic Energy Commission; and General Electric Company, which performed the nuclear design.

The principal reactor building, constructed of steel, aluminum and both conventional and high density magnetic concrete, is designed to prevent the escape of any fission products. The building foundation was blasted out of a solid lava formation, and extends 38 feet below ground and 65 feet above it. The floors and walls, ranging up to five feet in thickness, also serve as radiation shields.

The largest piece of equipment within the ETR is the reactor pressure vessel, a three-story, 10-foot average diameter cylinder of carbon steel clad with stainless steel. It contains the heart of the ETR—the uranium core with its experimental spaces.

The reactor vessel, although a precision instrument, has an operating weight of 175 tons, while the mechanical and pressure loads on its bottom head, 20 per cent of which is perforated to allow entry of experiment tubes and control mechanisms, total more than 650 tons. The vessel is cooled by high purity, demineralized water circulating through it at 44,000 gallons per minute. It is fueled with from 26 to 44 pounds of highly enriched uranium, and must be refueled every 20 operating days.

PATENT INCENTIVE SYSTEM

(Continued from Page 13)

stantial portion of the cost of obtaining the said patent. Be this as it may, it appears that the tax on the royalties which are received in the electronics industry alone, through patent license and other arrangements, just about equals the cost of operation of the Patent Office. Therefore, the Patent Office can be looked upon as a self-sustaining operation in the sense that it earns for the government taxes which greatly exceed the cost of operating the Patent Office. There are also those who are presently engaged in promoting enlargement of the Patent Office, new quarters for its examiners, and en-

(Continued on Page 32)

HARNESSING THE ATOM— OUR JOINT VENTURE

The following is excerpted from the address presented at Idaho Falls, Idaho, on October 2, 1957, during the Engineering Test Reactor Dedication Program by

SENATOR HENRY M. JACKSON

Member of the Senate Armed Services Committee and Joint Committee on Atomic Energy

—Fabian Bachrach

Senator Henry M. Jackson, (D-Wash.) is a member of four major committees of the Senate: Armed Services, Joint Committee on Atomic Energy (Chairman of the Military Applications Sub-Committee), Government Operations, and Interior and Insular Affairs Committee. He was elected to Congress in 1940 at the age of 28, served six consecutive terms, and was elected to the Senate in 1952. Last Fall, (August-September 1956), Senator Jackson toured the Soviet Union and came back with the observation that "the Soviets are determined to overtake the United States, industrially, by the mid-70's."

Senator Jackson was born at Everett, Washington, May 21, 1912. He was educated in the public schools of his native State, and has a law degree from the State University—worked his way through.

Senator Jackson is a bachelor.

. . . Like all other technological achievements, the Engineering Test Reactor was born in scientists' minds. It spent its cradle years in our laboratories. It approached maturity in the development and production shops of industry. And today, it has come of age at the National Reactor Testing Station. . . .

. . . My heartfelt congratulations to all those who brought the Engineering Test Reactor to maturity—the officials and staff of the Atomic Energy Commission, the Henry J. Kaiser Company, the General Electric Company, and the Phillips Petroleum Company.

As all of you know, the problem of finding materials which resist radiation and corrosion is perhaps the single most difficult, and important, technical problem of nuclear power development. The ETR is the most versatile materials testing reactor ever built. . . .

The Engineering Test Reactor was government-financed and will be government-owned. But it was designed and built, and will be operated, by private industry, under contract to the Atomic Energy Commission. In other words, this effort has used the talent and resources of both government and industry. It is a joint venture.

The joint venture formula—the pattern of government-industry teamwork—has been followed from the very outset by the Atomic Energy Commission. Our great atomic laboratories are Commission-financed, but contractor-operated. Our production plants for fissionable materials also follow this pattern. In my own state of Washington, the General Electric Company operates Hanford for the Atomic Energy Commission. The same formula has been used for our country's first full-scale civilian power plant.* The Shippingport reactor* will be paid for and owned by the Atomic Energy Commission, but it was designed by Westinghouse and will be operated by the Duquesne Light Company.

Think how different these past ten years would have been if the government had directly run our atomic energy program. All the talent, the drive, and the hard-headed practicality of free enterprise would have gone wasted. Our atomic program would never have gotten off the ground.

But also think how different this past decade would have been if private industry had been forced to develop atomic energy without the government's assistance. . . . the ETR would never have been built. Our weapons stockpile would now be a fraction of its present size and efficiency. . . . As for the prospect of competitive atomic power, that would be many decades away.

Fortunately, for our country and for the world, we understood from the start that taming the atom was too big a task for government alone, or industry alone. . . .

Our record in developing the military atom has been deeply impressive. . . .

The results achieved to date in harnessing the atom for peacetime power have been less impressive. Fifteen years have gone by since the first self-sustaining chain reaction, and we have yet to complete our first large-scale civilian power plant. The only large-scale plants which have actually produced atomic power are the naval reactors. . . .

. . . the civilian atomic power plants which we can now build . . . are many times as costly as conventional . . . facilities. This should not in itself discourage us. In the past every great new industry has gone through a long developmental period of high costs. . . .

Nothing could be more wrong, however, than to think that some dramatic scientific breakthrough will make power from the atom generally competitive with conventional electricity overnight. In all likelihood, a very long, a very difficult, and a very costly period of research, development, and prototype construction will be required . . .

We need to know far more about reactor kinetics; we

*Atomic power plant now under construction and nearing completion at Shippingport, Pennsylvania.

need to know far more about how to build components which withstand radiation. And above all, we need the kind of practical knowledge which comes only from designing, building, and operating full-scale reactors.

If the atom was simply another source of power in an energy-rich world, there would be no immediate cause for concern. We could then work . . . in a leisurely manner. We could tarry here, saunter slowly there, . . .

But the problem before us is altogether different. . . . to be sure, our short-term resources of conventional energy are relatively abundant. We are the exception, however. Most of the world is today energy-hungry.

More than any other single material factor, it is low-cost power, or the lack of it, which determines a nation's industrial might and its standard of living. . . . In Europe, Asia, Africa, and South America, cheap conventional energy sources are non-existent or else nearing exhaustion. The have-not energy nations have only one alternative if they are to raise their . . . standards of living: get atomic power and get it fast.

It may be perfectly true that our immediate domestic need for atomic power is less urgent than the rest of the world's. But this fact is of little interest to the energy-starved nations. . . . The rest of the world wants to know how it can get atomic power fast . . .

I will go further: If some other nation, be it Great Britain or the Soviet Union, gets there first with the best and the most in atomic power, the international prestige of our own country will suffer a severe blow. Our foreign friends are not interested in complicated graphs and statistics arguing that the British and Soviets had greater incentive to harness the atom for useful power. They are concerned with only one question: from what country can they purchase atomic power plants at the earliest date and the lowest possible cost?

I refuse to believe that the United States, the technological leader of the world, can settle for second or third best in civilian atomic power. . . .

Of course, it would be most convenient if we could prove the practicality of full-scale power reactors by building small, and rather inexpensive, laboratory models. Unfortunately, this just does not work. . . . The only way we will get low-cost atomic reactors tomorrow is by building high-cost experimental prototype reactors today. . . .

Now the scientists say there are almost 1,000 different types of power reactor systems which might work in theory. And they say also that there may be as many as 100 different types which merit serious investigation. But we will really not know which designs work . . . until they pass the ordeal of battle which they undergo here at the National Reactor Testing Station—actual operation of a full-scale reactor. . . .

The practical problem is this: How can we best mobilize and employ the manpower, the resources, and the money needed to build these prototype reactors, all of which cost far more than conventional power plants?

The joint venture formula points the way. We need the help of industry, and we need the help of government. Neither can do the job alone.

Private capital should take on as much of the burden as it can carry. As realists, however, we must acknowledge that the job ahead is simply too big to be financed mainly by private funds. . . .

The task before us, however, cannot be measured in a few tens of millions of dollars. We will be forced to spend hundreds of millions, or even billions, of dollars. . . .

The officials of equipment manufacturers and private utilities have solemn obligations to their stockholders and to their rate-payers. . . . These officials will be derelict in their duties if they attempt to shoulder the largest burden of atomic development and plant construction during this period of high-cost pioneering.

Whether we like it or not, large-scale government financial support is now needed, and will continue to be needed, for some time to come. . . .

When atomic power becomes commercially practical, it will be sold by public and private utilities, not the federal government. And when it becomes economically feasible for private capital to take on the main burden of atomic development, it should of course, be encouraged to do so. . . .

The issue is not public versus private power. We will have no power at all, either public or private, unless we now get on with the immense job of building prototype plants as quickly as possible. . . .

We know that the Soviets intend to replace us as the world's number one industrial power, if they can. The Kremlin is trying to beat us at our own game.

From its early days, the Communist regime has been pouring a major part of its resources into heavy industry and military power. . . .

In the weapons field, the Kremlin has steadily gained on us. . . . Today we are in a neck and neck race with the Soviets for the development of the intercontinental missile. . . .

The Soviets now rival us in technical know-how and the manufacture of marketable goods. . . .

The Kremlin recognizes the importance of nuclear power in its quest for industrial primacy. Russians are hard at work to produce such power at the earliest possible date.

And let's make no mistake about it—the competition is stiff. We should be able to win the race. . . . But this will require that we sustain a most imaginative and energetic research and development program.

Fortunately, our system of free government and free enterprise has a basic advantage. The Soviets are trying to achieve a great industrial effort under a tyrannical system that allows for little free communication or liberty of decision. . . .

. . . on October 27, this nation will open the observance of the 100th anniversary of the birth of Theodore Roosevelt. Amidst the complacency of these days, we need to hear again his summons to the vigorous life. . . .

Listen to this truly American voice:

"We know there are dangers ahead, as we know there are evils to fight and overcome, but, stout of heart, we see, across the dangers, the great future that lies beyond, and we rejoice as a giant refreshed, as a strong man, girt for the race . . . The greatest victories are yet to be won, the greatest deeds yet to be done. . . . There are in store for our people, and for the causes we uphold, grander triumphs than have ever yet been scored."

PATENT INCENTIVE SYSTEM

(Continued from Page 30)

largement of its staff in order to reduce backlog of thousands of applications which are pending examination in order to issue more quickly patents to those who have expended the time, energy and money to develop inventions which require the protection of patents for their commercialization.

This article is intended only as informational. The intricate fields of law and technicological endeavor which are involved are of course left to be considered by those who have or believe they have a patent problem. The purpose of this article is essentially to point out the importance of the patent incentive.

SPIDERS AID SCIENTIST IN AEROSOL STUDIES

ARMY CHEMICAL CENTER, MD.—Though hardly visible to the naked eye, spider silk is playing a surprisingly important role in studies here on aerosols. This fine thread, which is only 1/300th the diameter of the average human hair, may lead to numerous improvements to help man in many phases of life.

Richard V. Cogswell, laboratory technician in the Colloid Branch of the Chemical Warfare Laboratories at this post, is the man credited with putting the spider to work.

The story of Cogswell's encounter with the spider began several months ago. Cogswell, working on the study of tiny droplets of an aerosol, was faced with the problem of finding a fiber small enough to support the droplet without distorting its shape. One day he noticed a spider spinning its almost invisible web and figured he might have the answer to his troubles.

After bringing the spider to work and measuring the diameter of a single thread, Cogswell found it proved not only to be the right size, but the smallest fiber yet found. Exacting measurements revealed that the diameter of this spider's silk-like fiber was 7/1,000,000ths of an inch. In order to see the fiber, it must either be viewed under a microscope or against a black background with the aid of a flashlight.

The value of this find is that it permits the use of smaller droplets for study, and this, in turn, permits closer examination of the evaporation process. Due to the fine thread which can be used now, the droplet, which is supported on the fiber, maintains its original shape. In earlier tests on wider commercial fibers, the droplets tended to spread out. A good example would be to place a droplet of water on a flat object. Upon contact it will flatten out, losing the shape it had as it travelled in the air.

It is essential to make measurements of the qualities of a single liquid droplet of the smallest size possible. This leads to more accurate predictions about the behavior of clouds formed by great numbers of such droplets.

Previously, the smallest droplet which could be examined was 3/1,000ths of an inch. By using the spider silk, the droplets can now be as tiny as 1/2,500th of an inch.

After inducing the spider to spin thread by suspending it from a piece of cardboard, Cogswell winds the strands around the board. Then the fibers are mounted on small glass "collars," with the strands crossing the 2/5th of an inch opening around the edges. After subjecting the collars to aerosol sprays and getting one of

—U.S. Army Photo

"Technician Cogswell coaxing spider to produce the extremely fine thread he uses to mount aerosol for microscopic study." Picture below—glass collar used to hold fiber in preparing slide.

the droplets to land on the strand, they are mounted on slides for close study under a light microscope or used in such test instruments as a shock tube or a Millikan oil drop chamber.

From these studies it is hoped that enough will be learned to help in the making of better aerosol bombs (including most everything from paint sprays to deodorants); fuel injection systems for cars, jets, rockets and furnaces; chemical warfare agents and insecticides. It is also believed enough data can be obtained about fog behavior for some method of controlling or dispelling fog to be figured out.

Little Miss Muffet of Mother Goose legend can't be blamed for picking up her skirt and running away when she saw a spider—after all, she wasn't a scientist. Cogswell, though, made good use of his meeting with the spider and is helping to spin a web of mighty potential which may someday have important results for many of us.

RADIOISOTOPES

(Continued from Page 27)

ing processed at safe low levels. Carbon-14 might very well be used in the labeling of crude oil constituents—octane for instance—for easier tracing during the cracking process. Or, hydrogen-3 (tritium) labeling of incoming crude oil might be useful for operations not involving bond rupture—such as distillations—and at considerable savings in cost.

Walter S. Shead, editor of a nuclear industry weekly newsletter,* predicts, "Radiation processing in the chemical industry is looming as the next big 'break through' in the field of atomic energy as industrial research digs into the field of triggering chain reaction in chemicals on three fronts—with nuclear radiation from reactors, bombardment from high voltage accelerators and radiation from high activity radioisotopes."

Obviously, a good start on the "break through" has already been made. The new method of vulcanizing rubber mentioned earlier in this article is one example.

Work in the polymer field has shown that high level radiation from isotopes will initiate cross-linking between neighboring molecules. The side-chain bonds are easily broken by the radiation and immediately join with similarly disconnected bonds in adjacent molecules. (Figure 10) The result is a quite rigid, three-dimensional structure of different strength, heat, resistance, and other properties from the original. For instance,

*The Atomic Energy Guideletter, No. 96, Washington, D.C.

ordinary polyethylene will melt at about 80°C.; but after irradiation, it can withstand a constant temperature of 150°C. and, for short periods, 200°C. The irradiated plastic will also resist chemical agents such as soaps, detergents, oils, acids, and alcohols which would normally have an effect on the non-irradiated form. While radiation from radioisotopes may not compete with present commercial methods of producing many polymers, its ability to polymerize and cross-link without additives can yield special materials not possible or practical by other means.

Throughout the chemical and allied industries, research is showing the benefits to be achieved from radioisotope irradiation of materials. Already on the market is a superior adhesive tape produced by irradiation, and a synthetic rubber made from silicone gum. Hydrazine, a powerful rocket fuel, is being produced by irradiating ammonia, and, through irradiation, benzine and chlorine have been combined to produce a potent insecticide; and a major oil company reportedly has produced gasoline from crude petroleum by direct irradiation.

Research with radioisotope irradiation has transformed a layer of grease over metal, glass, or wood into a coating resistant to chemicals; converted paraffin into an insoluble, rubber-like material; changed hexane into formaldehyde; turned castor oil into a solid; made colorless glass turn brown and changed pure white diamonds to a pink or green color; brought about lightning changes in hydrocarbons which can be done no other way; made sawdust edible as a cattle food: changed sugar to acids; water-proofed leather; cross-linked the molecules in flooring so solidly they will not show indentation marks; and performed dozens of other "genii-like" miracles.

Possibly one of the most spectacular irradiation projects is that being done with foods. Meats, fish, and vegetables can be subjected to large amounts of gamma radiation and then kept in storage for much longer periods than presently possible. Considerable work in this field has already been done by the University of Michigan and several industrial laboratories. The Army plans to build a large food irradiation research center near Stockton, California, to further such research, since the Army Quartermaster Corps estimates that it may be possible to save $40 per man per year through the use of irradiated foods. Some of the early work done by the Quartermaster Corps on this project was performed in the Chemical Corps' radiological laboratory at Dugway Proving Ground in Utah.

WHILE THE radioisotopes and their utilization are a boon to industry, they are also opening up new fields of private enterprise. Most of the 100 firms currently buying radioisotopes in bulk from the AEC and packaging them for industrial and other uses are finding it necessary to expand their facilities to meet the growing demands for more and more isotopes in specific useful forms. Another 25 firms are in the business of making radioisotope-labeled chemical compounds for sale to industry—one Chicago firm lists some 200 carbon-14 labeled compounds alone, in its catalog.

In this regard, the Commission withdraws from certain areas of radioisotope processing when private industry reaches the point where it can handle a specific service. For instance, two radioisotope processing firms recently notified the AEC that they were now equipped to handle the encapsulation service for multikilocurie cobalt-60 sources. As a result, the Commission announced in September that as of March 1, 1958, it will discontinue encapsulation service for the public at large radioactive cobalt-60 sources.

The instrumentation field also benefits. There are more than a hundred organizations manufacturing more than a thousand types of instruments to detect radiation, to protect health and safety, and to perform gaging operations in various industrial uses of radioisotopes. In 1955, this segment of industry did some $32 million worth of business and by 1960, it is estimated, this figure will run as high as $50 million annually.

While the industrial utilization of radioisotopes is the brightest picture in the entire atomic energy program, any realistic appraisal of the situation must consider an inescapable fact—that future utilization of radioisotopes and the savings to be effected probably will not be as easily defined at as present.

One reason for this is that as isotope uses increase and become an accepted part of a new manufacturing or fabrication process, it will become increasingly difficult to pin-point the savings attributable only to their use.

For example, during the construction of the submarine Nautilus, many of the major welds were checked with cobalt-60 radiographs. To what extent the construction of the vessel might, or might not, have been held up had it been necessary to resort to the slower and less-satisfactory x-ray or radium-source inspection procedure is hard to say. In addition, if failure of some weld had resulted in loss or incapacitation of the submarine, it is difficult to say what fraction of the total cost of the vessel might have been "saved" had a radioisotope inspection technique been used.

A second factor to consider is that the "cream" may already have been skimmed off the top in the dramatically-apparent savings that can be made. That is, the early utilizations of radioisotopes were naturally undertaken in the areas where the greatest savings could be made with the greatest possible ease—especially regarding mass-use items. The cigarette industry, for instance, has expended much effort in the past to improve production quality control with respect to product weight. The average weight of a cigarette is an important factor in its quality. A light-weight cigarette burns both fast and hot, and cigarettes that contain more tobacco than necessary are hard to draw through and are costly, since tobacco represents about 90% of the production cost. The radioisotope provided a simple answer to the vexing problem. A density gage, using strontium-90, permits automatic adjustment of tobacco feed and contributes to the product uniformity.

James Watt's invention of the steam engine in 1765 brought about the "industrial revolution." Today, the radioisotope is creating a smaller but similar, and just as important, change in industrial production as a part of the new atomic era. In the past eleven years much has been done to adapt the radioisotope to industrial efficiency, and isotopic research has already shown an ever-broadening horizon of new and better products, especially in the field of chemistry.

As Dr. Libby pointed out to an American Chemical Society audience not long ago, "Our children and grandchildren shall without doubt praise us for the development of atomic energy for its peaceful uses. Without doubt there will be new uses made of which we have not dreamed, but among the important peaceful uses of all time will be the radioisotope. The chemist remains the principal applier of isotopes, the inventor of new uses, and the principal developer of ramifications as yet not named . . . Please think when you do your everyday work how you could do it better with isotopes . . ."

In the channel fog

HER ENGINE FALTERED

A few minutes out of Dover, fog wrapped the flimsy Bleriot monoplane like a shroud.

The pretty young woman in the smart flying costume (she'd designed it herself—"bloomers, blouse, and hood of mauve satin") glanced at her compass. It was the first time she'd ever used one. She thought of instructor Hamel's parting words:

"Be sure to keep on course, Miss Quimby, for if you get five miles out of the way, you'll be over the North Sea, and you know what that means."

She climbed to 6,000 feet. Freezing cold and still fog.

She pointed her nose down. The comforting clatter of the Gnome engine changed to a coughing splutter. It was conking out! She leveled off, figuring how she'd ditch.

To her relief, the engine suddenly took hold. Harriet re-checked her compass.

Some time later, breaking into clear sky, she saw a stretch of beach below. She put down at Hardelot; and on April 16, 1912, Harriet Quimby, first American woman to earn a pilot's license, became the first woman in the world to fly the English Channel.

As charming as she was brave, Harriet Quimby combined the thorough femininity and the self-confident ability which make American women like no others on earth. And help make this country so strong in character that investing in America is the wisest thing any American can do!

Today more than 40,000,000 of us have more than $41,000,000,000 securely invested in our country—through U. S. Savings Bonds. Bonds in which *America* guarantees the safety of our savings and the return we receive. There's no greater security! Buy Bonds regularly—where you bank or through the Payroll Savings Plan.

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PART OF EVERY AMERICAN'S SAVINGS BELONGS IN U. S. SAVINGS BONDS

CHEMICAL CORPS NEWS

BRIG. GEN. J. H. ROTHSCHILD IS HONORED ON RETIREMENT

—U.S. Army Photo

Brigadier General Jacquard H. Rothschild, Commanding General, Chemical Corps Research and Development Command, Washington, D. C., was honored with a retreat review at Fort Myer, Va., on Sunday, September 29, at 4 p.m. The ceremony marked his retirement with more than 27 years of service.

Troops of the 1st Battle Group, 3d Infantry (The Old Guard), and the United States Army Band rendered military honors and passed in review before General Rothschild.

General Rothschild was born in Cincinnati, Ohio, in 1907. He attended primary and secondary schools in Illinois, spent one year at the University of Illinois before entering the United States Military Academy from which he graduated in 1930. He received a Master of Science degree in Chemical Engineering Practice from the Massachusetts Institute of Technology in 1940.

In 1941, he became Commanding Officer, Chemical Warfare Service Development Laboratory at MIT From 1943 until its discontinuance at war's end, this laboratory developed gas masks, flame guns and flamethrower fuels. In 1944, he was given command of the 93rd Chemical Mortar Battalion and saw service in Europe with the battalion.

In August, 1945, he was assigned to the Office of the Chief, Chemical Warfare Service, and later organized and was Chief of the Research and Development Division. In June 1947, he became Assistant Professor of Chemistry at the United States Military Academy. In September 1951, he was sent to Japan as Chemical Officer, Far East. He returned to the United States in 1954.

General Rothschild holds the Legion of Merit with Oak Leaf Cluster and the Bronze Star Medal.

DR. HAROLD C. WEBER RECEIVES THE CERTIFICATE OF ACHIEVEMENT

EDGEWOOD, MD.—Dr. Harold C. Weber, chairman of the Chemical Corps Advisory Council since 1955 and an advisor to the Chemical Corps for the last seventeen years has been awarded a Certificate of Achievement by Major General William M. Creasy, for his "invaluable contribution to the Army Chemical Corps and the National Defense effort from 1940 to 1957." He was cited for "impressive leadership, tireless efforts in the national interest, and complete devotion to his country."

Dr. Weber, a Director-at-Large of Armed Forces Chemical Association, is a native of Boston. He has a bachelor's degree from Massachusetts Institute of Technology and a doctor of science degree in chemical engineering from Eidgenossische Technical Hochschule in Zurich. He is a Professor of Chemical Engineering at M.I.T.

COL. GROTHAUS IS THE NEW COMMANDER OF FT. DETRICK

—U.S. Army Photo

FORT DETRICK, FREDERICK, MD. —Colonel Donald G. Grothaus, whose last previous assignment was Commanding Officer of Rocky Mountain Arsenal, took command of Fort Detrick on August 6, succeeding Colonel John J. Hayes, who is attending Army War College, Carlisle Barracks, Pa.

Colonel Grothaus, a graduate of the U.S. Military Academy, has been in the Chemical Corps since 1941. During World War II he served as Chemical Officer and also as Deputy Chief of Staff of the Seventh Air Force in the Pacific. His other service includes duty as Commanding Officer of Chicago Chemical Procurement District, Chemical Officer of the Fourth Army, Deputy Commander of Army Chemical Center, and Assistant Commandant of the Chemical Corps School, Fort McClellan, Ala.

PARADE AND SERENADE IN HONOR OF COL. T. W. ROGERS

ARMY CHEMICAL CENTER, MD.—A special military parade was followed by a testimonial banquet at the Officers' Open Mess here recently to honor Lt. Colonel and Mrs. Thomas W. Rogers on the eve of Colonel Roger's retirement from the Army.

Troops of the installation enjoyed a respite from marching to the standard military march tunes as the 327th Army Band, under the guidance of Chief Warrant

Officer Benjamin Durant, rendered an "All-Southern" medley, including "Dixie," "A Star Fell on Alabama," and "Swannee River."

When the troops had passed in review before Colonel Rogers and Deputy Post Commander, Colonel Eugene G. Bennett, the band formed in front of the reviewing stand and continued to serenade Colonel Rogers with more southern music, climaxed with "Auld Lang Syne." The Rogers will reside at Athens, Georgia.

A graduate of the University of Alabama, Colonel Rogers holds an M.A. degree from the George Peabody College in Tennessee. He was commissioned in 1922 and was called to active duty in 1937.

—U.S. Army Photo

Lt. Colonel Thomas W. Rogers displays the scroll (king size) presented to him by his many post friends at a dinner at Army Chemical Center on the eve of his retirement. At left is Mrs. Rogers.

COL. MIDDLEBROOKS NEW 100TH GROUP COMMANDER

FORT McCLELLAN, ALA.—Col. Marvin A. Middlebrooks has been assigned as the Commander of the U.S. Army 100th Chemical Group (ComZ), replacing Col. Maurice A. Peerenboom who will assume command of Chemical forces in the Far East Command. Colonel Middlebrooks has been Deputy Commander of the Training Command since 1956.

A native of Waycross, Georgia, Colonel Middlebrooks majored in Chemistry at Auburn College, was commissioned in the Chemical Corps in 1942. He received the Army Commendation Ribbon for developing the Sampigny Chemical Depot in Europe in 1946.

RETREAT PARADE MARKS THE DEPARTURE OF GEN. STUBBS

Troops "present arms" as Brigadier General Marshall Stubbs (right, standing in jeep) troops the line at a special retreat parade at Army Chemical Center, Maryland, say "goodbye" to General Stubbs who has now departed for a new assignment at Fort Bragg, N.C. Standing in the jeep are: (left to right) Major General William M. Creasy, Army Chemical Officer; Lt. Colonel Fred Martin, Troop Commander, and General Stubbs. Colonel Harold Walmsley has succeeded General Stubbs.

—U.S. Army Photo

COL. FOLEY MADE DEPUTY C.O. OF ENGINEERING COMMAND

—U.S. Army Photo

EDGEWOOD, MD. — Colonel William Foley, former Deputy Chief Chemical Officer for Planning and Doctrine, has been named deputy commanding officer of the Chemical Corps Engineering Command at the Army Chemical Center.

A graduate of the University of Maine with a B.S. in chemical engineering, Colonel Foley was employed in the rubber industry, and as a school teacher before he was called to active duty in 1940. In World War II he served in the European Theater of Operations at Theater headquarters; at the Forward Echelon Communications Zone, and later, as Chemical officer and Assistant Operations and Training Officer of the 1st Division.

COL. LaPIANA TO SIXTH ARMY

—U.S. Army Photo

Colonel Vincent F. LaPiana has been named Chemical Officer for the Sixth Army by Lieutenant General Robert N. Young, the Army Commander. Col. LaPiana succeeds Colonel Pyueng S. Pyeun, who has been assigned to the Army's Chemical Training Center, Maryland.

Colonel LaPiana, a native of Milwaukee, Wisconsin, is an engineering graduate of Illinois Institute of Technology. He was commissioned and called to active duty at the outbreak of World War II, and in 1947 was integrated into the Regular Army.

During the Korean conflict, he served in Japan and Korea with the Chemical Section GHQ. He holds the Bronze Star Medal and the Army Commendation Ribbon.

NEW POST FOR COL. NEWLANDER

—U.S. Army Photo

FT. McCLELLAN, ALA. — Lt. Col. Julian A. Newlander has been appointed Chief of the Personnel and Administration Division of the U. S. Army Chemical Corps Training Command here, replacing Lt. Col. Steve C. Culuris, who has been assigned to Fort Baker, Calif.

A graduate of the University of Chicago, Colonel Newlander served during World War II in Washington and later in the Pacific. During the Korean conflict, he served in the 1952 campaigns with the 25th Infantry Division.

COLONELS ESSMAN AND PARKS GIVEN COMMENDATION RIBBONS

Colonel Graydon C. Essman was recently awarded the Army Commendation Ribbon with Metal Pendant, and Colonel Laverne A. Parks received the First Oak Leaf Cluster to the Commendation Ribbon with Metal Pendant.

The awards were announced in recent General Orders of the Chemical Corps.

COL. WEINLAND ASSIGNED TO DUTY AT FORT BRAGG

—U.S. Army Photo

ARMY CHEMICAL CENTER, MD.—Lieut. Colonel Arthur A. Weinland, post executive officer here for the past year, has been reassigned to the Chemical Corps School, Fort McClellan, Ala. He will serve as liaison officer to the First Logistical Command at Fort Bragg, N. C., where he and his family will reside.

A graduate of Michigan State College, Colonel Weinland worked as chemical engineer before he was called to active duty in 1942 as a First Lieutenant. He was integrated into the Regular Army in 1946.

Both Colonel and Mrs. Weinland have been active in military club work at this station. Colonel Weinland served one year as president of the post Rod and Gun Club. He is the vice president of the Army Chemical Center chapter, Armed Forces Chemical Association. Mrs. Weinland is president of the Army Chemical Center Officers' Wives Club.

HEADS THE NEUROLOGY BRANCH OF CHEMICAL WARFARE LABORATORIES

ARMY CHEMICAL CENTER, MD.—Dr. Kazuo K. Kimura, former chief resident in pediatrics at the Raymond Blank Memorial Hospital for children in Des Moines, Iowa, has joined the staff of the Chemical Warfare Laboratories at the Center as chief of the Neurology Branch.

While in Des Moines, Dr. Kimura established the Poison Information Center for the State of Iowa. The center provides doctors with information on diagnosis and treatment of poisoning cases. Since most of the victims of accidental poisonings are young children, Dr. Kimura's interest in drug action and his choice of pediatrics as a medical specialty inspired him to establish a central point to collect this information.

Dr. Kimura has published more than 20 scientific articles.

In addition to his medical degree from St. Louis University, Dr. Kimura has a Ph.D. in pharmacology from the University of Illinois; a bachelor of science degree in pharmacy from the University of Washington and a master of science in pharmacology from the University of Nebraska.

Although he was born in Sheridan, Wyoming, Dr. Kimura calls Seattle, Washington, his "home town," as he moved there when he was eight years old.

SIX MATERIEL COMMAND EMPLOYEES WIN AWARDS

Six civilian employees of Materiel Command Headquarters at Army Chemical Center recently received certificates presented by Colonel C. B. Drennon, III, Deputy Commander, in a ceremony held in the office of the Post Commander. They were—Messers. William Harward, Eugene Smith, David Shepard, John Caines, Frank Abbruscate and David Bourque. Two service pins, one suggestion award and certificates representing a total of 5,000 hours of accrued sick leave were presented.

GOLF TROPHY FOR COL. METZGER

Before leaving for his new assignment as Comptroller at Pine Bluff Arsenal, Arkansas, Lt. Col. Ralph A. Metzger, Chemical Corps, was presented the Charles E. Wilson Golf Trophy, by Brig. General Carson A. Roberts, USMC, Director, Office Armed Forces Information and Education, Office, Secretary of Defense. In addition to having his name engraved on the Trophy for the second year, Col. Metzger also won the Military District of Washington Senior Golf Tourney. Col. Metzger for the past four years has been Comptroller, Office Armed Forces Information and Education, OSD.

NEW PROFICIENCY AWARDS

Since the last issue of the JOURNAL in which recent proficiency awards in the Chemical Corps were listed, the following additional awards to personnel in the office of the Chief have been announced. Each award consisted of a certificate accompanied by a Treasury check.

Sustained Superior Performance Award

Mr. Robert E. Cummings, Supply Requirements and Distribution Officer, Office of the Assistant Chief Chemical Officer for Planning and Doctrine.

Mrs. Anna C. Elkins, Secretary, Logistics Planning Division.

Mrs. Mabel B. Guerin, Administrative Assistant, Career Management Division.

Mrs. Ethel G. Hickerson, Clerk-Stenographer, Office of the Comptroller.

Mrs. Eleanor A. Horn, Secretary, Logistics Planning Division.

Mr. Edward S. Johnson, Chief Budget Branch, Comptroller's Office.

Mrs. Vivien B. Kania, Secretary to the Chief of the Administrative Services Branch.

Mrs. Frances L. O'Donnell, Law Clerk, Legal Advisor's Office.

Mrs. Ada R. Stanley, Forms Clerk, Office of the Comptroller.

Army Suggestion Award

Mr. Pat R. Brewer, Comptroller's Office.

Mr. John G. Dudley, Jr., Property and Supply Clerk, Administrative Services Branch.

Mrs. Florence H. Kennell, Administrative Division.

Mr. Alexander A. Landini, Comptroller's Office.

Miss Dorothy J. Lattin, Military Personnel Clerk, Career Management Division.

Miss Clara V. White, Mail Clerk and Typist, Cml Corps Intelligence Agency.

Outstanding Employee Rating

Mr. Leo J. Holland, Jr., Career Management Division.

Mr. Charles W. Lombard, Deputy Comptroller.

Army Certificate For Outstanding Performance

Mr. Delbert H. Flint, Administrative Officer, Career Management Division.

Mr. Rudolph E. Hegedahl, Administrative Officer, Administration Division.

Achievement Certificate

Mrs. Alma Kieny, of the office of Research and Development Command, at Gravelly Point, Virginia.

CHEMICAL CORPS OFFICER WINS DOCTORATE HONORS

FORT DETRICK, MARYLAND—Lieutenant Marc Nerlove, Chemical Corps, of the Program Coordination Office, was awarded top honors for the best doctorate thesis in Agricultural Economics in 1956. The thesis was submitted at Johns Hopkins University. This high honor, which carries a $250 award, was announced at a recent meeting of the American Farm Economic Association, which sponsors the award. Title of the thesis was—"Estimates of the Elasticities of Supply of Corn, Cotton and Wheat."

Lieutenant Nerlove is the son of S. H. Nerlove, Professor of Economics at the University of Chicago. He received his doctor of philosophy degree at Johns Hopkins last November.

ROY M. ACKER WINS AWARD FOR OUTSTANDING PAPER

Roy M. Acker, an R & D civilian employee recently received a $100 cash award for his outstanding paper presented at the Army Science Conference held last June at West Point.

GERM INCUBATION VEST PATENTED

An "incubation vest" to facilitiate bacteriological field tests by allowing germs to grow at body temperature was recently patented by four scientists at the U.S. Army Chemical Corps Biological Warfare Laboratories, Fort Detrick, Frederick, Maryland.

The vest speeds testing of bacteriological samples collected in the field by providing for incubation before the samples are returned to the laboratory.

With the vest, samples can be collected, placed in Petri dishes and inserted in pockets. The vest keeps the sample at body temperature. Since this is the ideal climate for most germs, clusters or "colonies" of bacteria will form in the Petri dish, the first step in routine tests for identification of microbes.

Without the vest, it is necessary to find refrigeration for the samples, or trust to luck that they will keep in good condition until they reach the laboratory.

The vest, developed by Francis M. O'Leary, Dr. Elizabeth C. Mayo, Earle F. Alexander, and Mrs. Merle H. Kaltenbach, is part of a biological warfare sampling system, developed at Fort Detrick and currently undergoing tests by the Army Chemical Corps.

CAPTAIN FRANCES BERG IS NOW COMMISSIONED IN REGULAR ARMY

Captain Frances Berg, Women's Army Corps, Public Information Specialist in the office of the Chief Chemical Officer, Department of the Army, was commissioned last August as a Captain in the Regular Army. Hers was one of only two such appointments of WAC officers in the Washington, D.C. area, made recently under the Armed Forces Regular Officer Augmentation Act of 1956.

Maj. General William M. Creasy, Chief Chemical Officer, in an office ceremony presented the Regular Army commission to Captain Berg. He also sent her a letter of congratulation.

Colonel Mary Louise Milligan, Director of the Women's Army Corps, in a letter extending her congratulations to Captain Berg, stated—"The fact that you have been selected to be a Regular Army officer is irrefutable evidence of the fine record you have established while serving your country as a member of the United States Army Reserve. The Regular Army will be enriched by the talents and abilities which you are bringing to it."

Another such letter came from Lt. Colonel Luta C. McGrath, WAC Staff Advisor, in which she commended Captain Berg highly on her record as a reserve officer and expressed pleasure in the recognition of her services reflected in this appointment.

Captain Berg, born in Long Island, New York, attended Fairleigh Dickinson College in Rutherford, N.J. She joined the WAC in February 1950, and was commissioned 2nd Lieutenant in December of that year. She was promoted to 1st Lieutenant in 1952 and to Captain in the WAC Reserve in 1956.

Captain Berg has also served at the Army Chemical Center, Maryland, and at the New York Chemical Procurement District.

GENERAL LARSEN ADDRESSES ADVANCED COURSE CLASS

FORT McCLELLAN, ALA.—An address given by Brig. General Stanley R. Larsen, Assistant Commandant of the Infantry School, Fort Benning, Georgia, highlighted the opening exercises recently conducted here for the 12th Chemical Officers' Advanced Course. Upon arrival, General Larsen, accompanied by Col. J. M. Palmer, Commanding Officer, U. S. Army Chemical Corps Training Command and Col. Carl V. Burke, Commandant of the U. S. Army Chemical Corps School, reviewed the honor guard composed of members of the 100th Chemical Group. Afterwards a reception was held in the school library.

In his address to members of the class and their families, General Larsen stated—"The ever changing and fluid system of warfare which the United States may have to face in the future presents a continual challenge to all military personnel."

THE HISTORICAL CORNER

DR. IRVING LANGMUIR

By Brooks E. Kleber
Historical Office, Chemical Corps

Dr. Irving Langmuir died in August and his passing was deeply lamented by the scientific world. The accomplishments and honors of the seventy-six year old scientist, who spent most of his career on the research staff of General Electric Company, were varied and many. He invented the gas-filled incandescent bulb and the high-vacuum power tube, both basic tools for much activity in modern life. With his associate, Dr. Vincent J. Schaefer, Langmuir developed the process of seeding clouds with dry ice particles which induced rain artificially. He was the first American industrial chemist to receive the Nobel prize.

But to us in the Chemical Corps Dr. Langmuir is best noted for still another achievement, the development (again in collaboration with Schaefer) of the first mechanical smoke generator. Although this first model, the M1 or, more commonly, the Esso, has long been superseded, its principle of smoke generation has been employed in every subsequent generator. Previous smoke actually had been the product of the burning of various fuels or chemicals. Langmuir's generator produced "smoke" when superheated fog oil passed from the generator into the cool air. In other words, the "smoke" was not the result of combustion, but was the condensation of the fog oil into myriads of oil droplets.

The mechanical generator greatly affected the overall mission of the Chemical Corps. Until a time well into World War II, doctrine for large area screens envisioned the obscuration of potential targets in rear areas only. This view was influenced not a little by the size, the low efficiency, and the high demands in fuel and manpower of the available generators. Although the M1 generator was still too heavy and cumbersome for general frontline use, its efficient production of smoke pointed the way toward the practicable employment of large screens in forward areas. The M2 model, which used the Langmuir technique of producing smoke, was lighter and less bulky than its predecessor. The characteristics of the generator, along with the decline of the Luftwaffe and the consequent need for rear area concealment, led to the spectacular success of smoke units in concealing many river crossings in the European theater in World War II.

Dr. Langmuir's versatile mind had served his country well in war as well as in time of peace.

RICE EXTRACTS INHIBIT PLANT VIRUS

STANFORD, CAL.—A possible means of preventing virus infections in plants was announced here by scientists from the Army Chemical Corps Biological Warfare Laboratories at the American Institute of Biological Sciences meeting at Stanford University on August 26, 1957.

Extracts from rice plants, the scientists found in initial experiments, will inhibit growth of some plant viruses.

Lieutenant Thomas C. Allen, Jr., and Dr. Robert P. Kahn have hopes for widespread use of their "vaccine" but quickly point out that their only results have been from laboratory experiments with greenhouse plants rather than the field trials necessary for conclusive evidence.

Most of the experiments were conducted by inoculating Pinto bean plants with tobacco mosaic virus. Some of the plants were then dipped into solutions containing rice extracts. In most cases, the treated plants grew and remained healthy while untreated plants died or were severely damaged.

CHEMICAL WARFARE

(Continued from Page 23)

years later, studies of World War I casualty rates showed that Playfair had made a remarkably accurate guess.

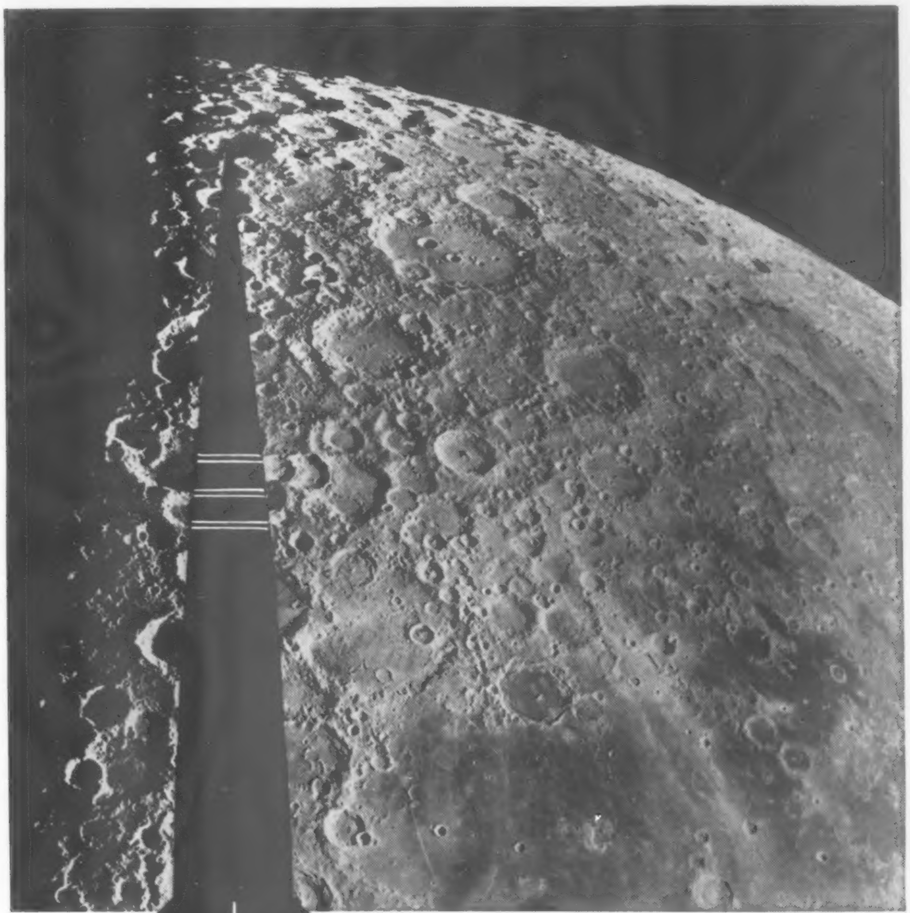
There is no question as to the practicality of Playfair's ideas, but if the British Army had adopted his chemical shells, to what extent could they have been used during the Crimean War? The probable answer is, not on any scale comparable to the use of chemical shells in World War I. Chemical industry had not yet reached the point where phosphorus and cacodyl cyanide could be prepared on a large, inexpensive scale. Phosphorus was still being made by the old process of treating bones or phosphate rock with sulfuric acid, evaporating the solution, and then reducing the calcium phosphate with coke in retorts. The modern electric furnace method was not introduced until some years later. Carbon disulfide was made by passing sulfur vapor over heated charcoal in retorts. The same reaction is used today, but our technique is much more refined and efficient. And as for cacodyl cyanide, the government would have had to set half the chemists in the British Isles at work to get sufficient material for the bombardment of one Russian warship.

Lyon Playfair, at this time, was head of the Department of Science and Art in the British government. He had attended the universities of St. Andrews, Edinburgh, and Giessen, and had studied under Justus van Liebig. At the age of twenty-two he came into prominence by translating Liebig's *Organic Chemistry* into English. He worked as a textile chemist, taught chemistry, and finally came to the attention of Sir Robert Peel, the Prime Minister. Peel drew Playfair into government work, and thenceforth Playfair had two careers. On the scientific side he carried out several respectable research projects, was appointed chemistry tutor to the Prince of Wales, and finally was elected Professor of Chemistry at the University of Edinburgh, the most famous Chair of Chemistry in Great Britain. On the political side he was elected to Parliament; he became the Postmaster-General and President of the Civil Service Commission, and he held several other important positions. At the time of his death in 1898 at the age of eighty, a long list of abbreviations followed his name, including P.C., G.C.B., F.R.S., and LL.D.

Lyon Playfair *almost* became the father of chemical warfare, but his ideas, like those of many other inventors, were ahead of his time. A half century went by before the German chemist, Fritz Haber, released chlorine at Ypres and opened a new phase of warfare.

Bibliographical Note. The quotations above, as well as the picture, were taken from Wemyss Reid's *Memoirs and Correspondence of Lyon Playfair, First Lord Playfair of St. Andrews* (New York & London, 1899). Playfair's articles on chemistry may be found in the British chemical journals of his day. Most of the reports issued in his capacity as a public servant were published in pamphlet form.

FLUORINE



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